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312,692

ALIEN PROPERTY CUSTODIAN

FULL FASHIONED HOSIERY

Hans Thierfelder and Ernst Dietz, Auerbach I. Erzg., and Max Richter, Chemnitz, Germany; vested in the Alien Property Custodian

Application filed December 11, 1936

This invention relates to full fashioned hosiery, and particularly to the connection of the heel portions with the adjacent hose portions.

According to the invention, each heel portion is connected with the adjacent hose portion not only by the course by means of which it is worked onto another hose portion, particularly the leg, but also on its side edge, angularly positioned to said course, by its own thread in such manner that double loops are present at the latter juncture.

By way of example, two embodiments of the invention are illustrated in the accompanying drawing, in which Figure 1 shows the parts essential for understanding the invention of a stocking coming from the legging machine; Fig. 2, a portion of the stocking after transfer to the heel making machine; Fig. 3 is a plan showing a phase during working on of the heel; Fig. 4 shows the foot portions of a finished stocking; and Figs. 5, 6 and 7 show another structure according to the invention with reference to Figs. 2, 3 and 4.

Referring to the drawing, the stocking is not produced in one operation, but connecting to the leg **1** the blank **2** of the foot and on each side thereof half a sole **3** and **4** and the toe **5** are worked in known manner on a flat hosiery frame. Before the sole portions **3** and **4** are started, the slack or separating courses **6**, **7** or several auxiliary courses in tubular form are interposed at the points concerned, or instead thereof a plurality of auxiliary courses may be worked at the end of each high heel and pressed off, whereupon the soles are started by working new initial protective courses, operation on the middle sections ceasing while the auxiliary and initial courses are being worked. The foot portions may be wider than the leg.

After the leg **1** with the worked-on foot portions has been taken off from the machine it is transferred to a transfer bar along the courses **10**, **11** indicated by dots in Fig. 1. Then the slack or separating courses **6**, **7** are cut up and the blank **2** is folded with the sole portions **3**, **4** on the side of the leg **1** in such manner that the initial courses **12**, **13** of the half sole portions **3**, **4** can be transferred adjacent to the courses **10**, **11** to the needles of the transfer bar, either irregularly or by placing each loop on a needle. After this has been done, all transferred courses can be transferred from the transfer bar to the needles of a heel making machine or another flat hosiery frame suited for making heels. Instead of transferring the courses indirectly to the frame needles, they could also be transferred directly.

When the courses **10**, **12** and **11**, **13** are positioned on the needles of a hosiery frame in the manner indicated, a heel portion **14** can be worked onto each of the courses **10**, **11**. The courses **12**, **13**, however, must not be knocked over, and the needles supporting them should therefore not be closed. For this reason, the heel making or other suitable machine employed, deviating from the usual construction thereof, should be provided with known devices for preventing the pressing of these needles. If necessary, the presser edge must be recessed at the points concerned.

Corresponding to the completion of the heel portions, for instance after every second course, all loops **12**, **13** of the first part of the soles are hung over to the extent of one or more needles in the direction of the adjacent heel portion **14**. For this purpose, the machine must be equipped with narrowing mechanisms of corresponding width. The loops of the first part of a sole brought during hanging over within range of a heel portion **14** are connected therewith at the next knocking over operation. The number of loops of the first sole portions remaining on the needles of the machine is thus gradually decreased, so that after a certain number of courses the structure shown in Fig. 3 is produced. Along the line **15** the first part of the sole is connected with the part of the heel portion **14** that has been completed in the meantime, and the remaining edge portion **16** of the half sole concerned is during further working of the heel portion **14** gradually brought together and connected with the latter, so that on a finished stocking according to Fig. 4 there is no seam along the line **15'**, but the inner border loops of the heel portions are superposed on the loops of the first sole portions or on the intermediate courses joined to the latter to form double loops.

If direct connection of the first sole portions transferred to the frame needles either irregularly or regularly by placing each loop on a needle with the heel portions is to be avoided, it is possible, prior to or during the beginning of heel making, to work onto the courses **12**, **13** one or more plain courses which preferably consist of a reinforced thread or are produced together with the first courses of the heel portions **14** so as to extend over the entire fabric on the frame needles. Similar intermediate courses, moreover, may be joined also during the making of the heel to the remaining portion of the first sole part so as not to endanger the initial loops of the half sole portions by repeated hanging over or in order to impart to the foot portions of the stocking a particular shape.

To prevent ravelling of the first part of the sole up to the course transferred to the needles of the heel making machine during working or subsequent use of the stockings it may be advisable to insert courses which prevent runs between the slack or separating courses 6, 7 and the courses 12, 13. The antirun ravel stop may be formed by horizontally drawn out loops or by a tuck or open work pattern, and several of these courses may be worked at the beginning of the sole portions. The ladder-proof portions of the goods need not terminate at the courses 12, 13 to be transferred, but may extend at will into the half sole portions.

Furthermore, it is not necessary to superpose only the inner border loops of the heel portions and the loops of the first sole portions to form double loops, as both portions of the fabric can be united to a still greater extent by covering one portion with the other for more than two, say, three, four or five, needle divisions, which is particularly advantageous near the heel angle. This covering may be gradually reduced by laterally racking the part of fabric concerned at the beginning of the heel over five needles and selectively imparting to the following courses a connection produced by covering and as required by the material used. The number of needles provided with double loops is reduced as much as possible during further working of the heel portions and may become as low as one.

When therefore the first courses of the heel portions are worked and after production of whatever courses are preferred the latter are hung over in the direction of the sole portions or the latter in the direction of the heel portions, this hanging over operation must during the production of the first courses of the heel portions be effected to the extent of more than two needle divisions, for instance in such manner that the first hanging over operation involves five frame needle divisions, the next four, the following one three, the subsequent one two and that any further hanging over if necessary is restricted to one frame needle. The result will be the oblique limiting line 18 of a triangular plane 19 within the heel angle, as indicated in Fig. 6, where all loops of the plane piece 19 form double loops due to the union at that point of the corresponding loops of the heel portion and the formation of a sort of split seam. The provision of this triangle 19 consisting of double loops considerably increases the strength of the stocking within range of the heel angle. It is further possible laterally to rack the first courses over only two frame needles, then gradually to hang over the following courses to the extent of more wales and, finally, gradually to hang over fewer wales. In this instance the piece 19 will not be triangular.

Instead of working the main heel portions 14 onto the last courses 10, 11 of the high heel portions 8, 9, they could be worked also with or without intermediate courses, according to Fig. 5, onto the initial courses 12, 13 of the first sole portions 3, 4 transferred to the frame needles beside those courses, so that the wales of the main heel portions extend in the same direction as those of the sole portions and in the finished stocking are therefore disposed transversely to the wales of high heel, as indicated in Fig. 7. On the back line of the main heel portions an elastic seam may be provided for taking up tensile stressing, if any, of the heel portions and thereby rendering the wearing of such a stocking more satisfactory than that of hosiery worked in the ordinary manner. Owing to the changed direction of the wales within the main heel, the latter possesses greater elasticity in the longitudinal direction of the stocking, whereby the durability and life of the latter is increased, particularly with respect to tearing off the high heel portions.

The heel portions may be constructed so that the courses bordering on the initial courses 12, 13 of the sole consist of the same kind of thread as the sole, for instance real or artificial silk, to make the heel angle as invisible as possible, and that only the courses of the heel portions 14 lying towards the back seam are worked from a stronger thread, such as a multiple lisle thread.

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PUBLISHED

MAY 4, 1943.

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FULL FASHIONED HOSIERY

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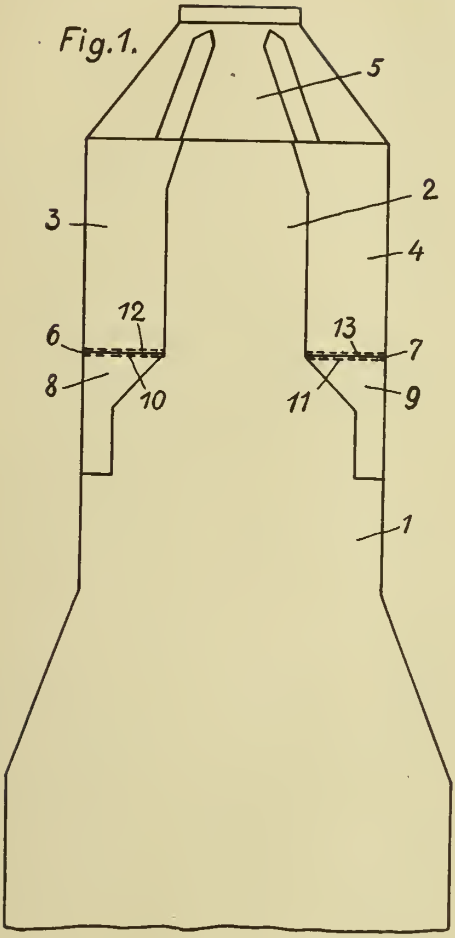

Fig.1.

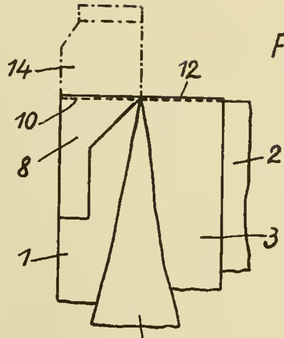

Fig.2.

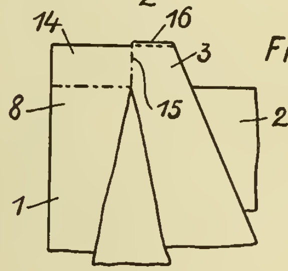

Fig.3.

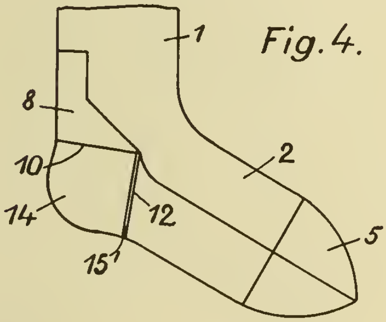

Fig.4.

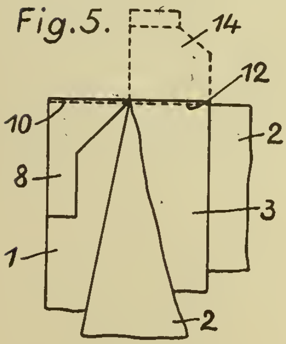

Fig.5.

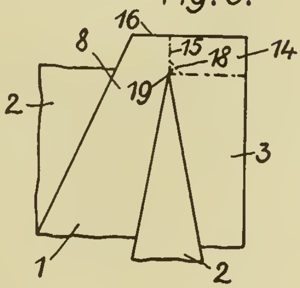

Fig.6.

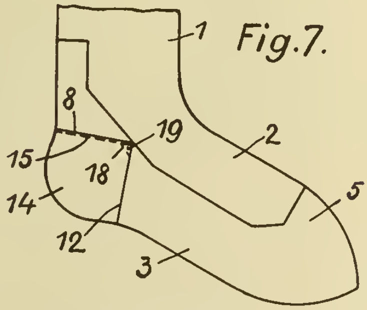

Fig.7.

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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF PURE CELLULOSE

Martin Gunther, Berlin, Germany; vested in the Alien Property Custodian

No Drawing. Application filed January 23, 1937

This invention relates to improvements in the production of pure cellulose. In this field, for example also in the manufacture of semi-cellulose, it is already known to saturate straw and similar grasses with soda lye and to decompose them in rotary boilers with the simultaneous supply of steam.

In operating with rotary boilers, for example in the production of semi-cellulose from straw and similar grasses, it has also been proposed to displace the air from the fibrous material saturated with a minimum of alkali solution, as well as from the boiler itself, by means of steam, and to apply then fresh steam.

It is likewise not novel in the art to boil straw and other grasses, using a rotary boiler, in the presence of excess alkali solution, with superheated steam.

It is an object of this invention to combine the detail measures referred to above so as to establish a one-turn procedure. A further object of my invention resides in simply saturating the straw and like grasses with soda lye without contacting it with excess lye, there being, however, at the bottom of a boiler (ball or tumbler boiler) receiving the straw a small quantity of treatment liquor which collects there.

More particularly, the invention consists in a combined process for producing pure cellulose by the decomposition of straw or similar grasses by soda lye in a rotary boiler, wherein the fibrous material is simply saturated with the decomposing liquid, the air being driven out by steam, and wherein the charge is finally steamed with dry superheated steam without increasing the content in moisture. At the same time, the air is not only driven out of the fibrous material, but also of the boiler, in order to avoid damaging the cellulose by oxidation.

Contrary to the process above first mentioned as known, by which immediately after the commencement of working, owing to the supply of steam, the proportion of decomposing liquid to fibrous material is varied by the condensed steam, according to the process of the invention, the charge is worked with a constant content in moisture and, thus, also with substantially uniform constitution of the decomposing agent itself, by the use of dry steam.

As compared with the last mentioned of said known processes, the process according to this invention differs in that the treatment is carried out whilst avoiding an excess of liquid, that is, the process is performed not by boiling but simply by steaming the material so that injurious effects on the cellulose by an excess of alkali are avoided. The process according to the invention will now be explained more fully with reference to an example:

20 kilograms of chaff cut from corn straw are placed in a tumbler boiler of 200 litres capacity. To this are added about 60 litres of water or waste lye with the addition of 2 kilograms of caustic soda or a corresponding concentration of weak waste lyes, and with the simultaneous addition of 100 grams of sulphite or hydrosulphite as a reducing agent. The boiler is closed and rotated for about ¼ hour. When the decomposing liquid has thoroughly saturated the material, dry superheated steam is supplied. The boiler valves are then closed and after a number of rotations the exhaust valve is opened and fresh steam is blown through for 5–10 minutes for the complete removal of the air. This treatment is repeated two or three times.

Steaming then takes place with dry superheated steam at about 5 atm. and for about 1½ hours. The temperatures here amount to about 140–175° C. After 1½ hours, blowing out takes place and the material which is now almost completely decomposed, is washed.

After the washing, the drained material freed from the washing liquid is again placed in the boiler and is subjected with a lye which contains about 1½ kilograms caustic soda to 10 litres of water and 100 grams of sulphite as above stated, to a second steaming with dry superheated steam. After about 1½ hours, the steam is blown out, 20 litres of fresh water are added and thus the major part of the caustic soda attaching to the material is carried away. The waste liquor recovered after draining off can, as above mentioned, be added to fresh chaff.

The material is then washed until it is free from alkali. The like decomposing stages following each other according to the example can with advantage be also carried out in a single working process if the treatment takes place with a corresponding increase of the concentration of the soda lye (30 litres of water, 2½ kilograms of caustic soda) and an increase of the duration of the treatment (2 to 2½ hours).

The decomposition even of the stalk knots and the like is then complete. The sifting waste amounts, in the case of double stage process, to about 2 to 3½, but with the single stage process, on the contrary, it is only 0.1 to 0.5% of the initial material. Hydroxycellulose cannot be seen; the yield amounts to about 50 to 55%.

It is to be understood that the detail steps of the novel process can be varied without departing from the spirit of the invention.

MARTIN GUNTHER.

Published May 4, 1943

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ALIEN PROPERTY CUSTODIAN

FILM MAGAZINES FOR CINEMATOGRAPH CAMERAS

Paul Storch, Berlin-Charlottenburg, Germany; vested in the Alien Property Custodian

Application filed January 25, 1937

My invention relates to improvements in film magazines for cinematograph cameras.

In cinematograph cameras it is well known in the art to employ film magazines which may be brought into engagement with the mechanism of the camera in two positions by turning the same through 180° and in which a film is provided with two rows of correspondingly smaller pictures arranged side by side for the purpose of effecting a saving in photographic film.

According to the invention the known film magazines of the above-mentioned type are so designed as to form two separate film receiving compartments within the magazine, each of which is capable of receiving an individual film, preferably of a particularly narrow size.

If it is desired as above mentioned to limit the width of the pictures to a portion of the usual film width of, for instance, 16mm so as to effect a saving in photographic film, the latter may be reduced according to the invention to the desired width (for instance 8mm) before exposing the film and the same amount of photographic film is nevertheless available in a single magazine as is the case with a magazine of approximately the same size containing a film to be exposed in two rows. But cutting the film before its exposure in the longitudinal direction into two strips each having a width required for the projection, not only the difficulties which would otherwise be encountered in the reversing development are avoided but also it is possible owing to the particular design of the magazine according to the invention to remove an already exposed film strip therefrom without thereby exposing the other film strip to light.

The film guide parts of the magazine are preferably so designed and arranged and caused to cooperate with the fixed guide surfaces in the camera that an insertion of the magazine in the camera is possible without changing the position of the film with respect to the magazine. Although it is known in the art to make such provisions for magazines having but one film receiving chamber, yet they imply an improvement in the type of magazine according to the invention.

The exposure apertures for both film strips may lie adjacent to each other on the same narrow side of the magazine. In this case, the second position in which the magazine may be brought into engagement with the camera mechanism is attained by rotating the magazine through 180° about an axis extending parallel to the optical axis. However, it is also possible to arrange the exposure apertures for the film strips placed in both magazine compartments in the opposite narrow sides of the magazine, the second position in which the magazine may be brought into engagement with the camera mechanism being attained by rotating the magazine 180° about an axis perpendicular to the optical axis and to the reel axes.

The guard usually employed in film magazines may be used according to the invention for the exposure apertures of the two magazine compartments. Furthermore, it is preferable to provide a shifting of this guard in two directions and to design the guard in such a manner that upon a shifting in either direction always one exposure aperture, whereas in the other direction the other exposure aperture and/or the aperture for a film pressure plate secured to the camera is uncovered.

It is also known to employ a guard with an extension by which a locking device is simultaneously released for the supply film reel upon uncovering an exposure aperture. In magazines according to the invention the common guard for both exposure apertures may be provided with a plurality of such extensions which are so designed that in one end position of the guard always only one of the supply film reels, whereas in the second end position the other supply film reel is released, while in the central position both supply film reels are locked.

In the magazine according to the invention particular means for preventing a loosening of the supply film reel may be furthermore dispensed with owing to the small width of the film and, therefore, to the reduced elasticity inherent in the film (compared to magazines with the same size of picture but for the production of various rows of pictures lying side by side on the same film). In this manner a magazine is obtained which is simpler in construction, more economical and approximately as reliable as the hitherto employed.

If the exposure openings for both films are not arranged on the same narrow side of the magazine, it is preferable to allot a guard to each exposure opening. The same provision may be made if the exposure openings for both film compartments are immediately adjacent to each other. In the film magazine designed according to the invention it is also possible to cause the supply film reel to be driven by friction existing between the two reels. This provision which has given very good results in practice would not be practicable if, as is the case with the known magazines, each of the reels would alternately have to serve as a supply film reel and as a take-up film reel and both reels are, therefore, spaced from each other a certain distance.

In the accompanying drawings are shown some embodiments of my invention in diagrammatic form.

Fig. 1 shows a longitudinal section of a magazine taken on the line A—B of Fig. 2.

Fig. 2 shows a top view thereof.

Fig. 3 is a transverse section of the same magazine taken on the line C—D of Fig. 2.

Fig. 4 shows schematically a second form of the magazine partly in section in which the exposure openings of both film compartments lie on the opposite narrow sides of the magazine.

Fig. 5 shows a particular form of the guard.

Fig. 6 is a section through a modified take-up film reel.

In Figs. 1 to 3, 1 denotes the magazine body having a division wall 2. By this division wall and the covers 3 and 4 two film receiving compartments 5 and 6 are formed. Each of these compartments is adapted to store a supply film reel 7 and is further more equipped with a take-up reel 8. The pot-shaped take-up reel 8 is placed with its open side over a circular aperture 9 arranged in the cover, the edge of the opening 9 projecting into the hollow space of the take-up reel 8 for the purpose of excluding the light. Grooves 9*a* arranged in the take-up reel 8 serve to couple the driving pin of the camera with the take-up reels.

The take-up reel is preferably provided on its front surface with a dowel by means of which the take-up reel is held in the proper position when placing the cover over the magazine body. The take-up film reel 8′ as shown in Fig. 6 may at the same time be secured to the magazine as indicated at 29.

The supply film reels 7 are firmly mounted on a core piece 10 which is loosely mounted on a pin 11. In order that the supply film reel may be driven by the take-up film reels, the pin 11 is secured to the free end of an oscillating arm 12. This arrangement permits a pressing of the supply film reel under the action of its weight against the periphery of the take-up film reel so as to be rotated by the friction caused thereby.

A loosening of the supply film reel may also be prevented in a well known manner by depressing a pin 13—displaceable in each magazine cover in the longitudinal direction against the action of the springs—on the core piece 10 with the aid of an extension of a guard to be hereinafter described. In this case, the pin 13 may engage in a groove 14 arranged in the front surface of the core piece in the direction of the diameter.

As will be apparent from Fig. 3 the exposure apertures for both film compartments lie immediately adjacent to each other. In addition to the magazine itself Fig. 3 shows the film gate 15 firmly secured in the camera as well as the pressure plate 16 forming a part of the camera. The two films 8 mm in width and preferably perforated on one edge are designated by the numeral 17. In this arrangement, the position of the film with respect to the lens is exclusively determined by the constructive parts of the camera. The film is laterally guided on the one hand by the lateral projection 18 of the film gate and on the other hand by the central wall of the magazine supporting the film gate 15. This wall may be corrugated in the neighborhood of the film gate in order to obtain the desired thickness or reinforcements may be arranged in the neighborhood of the film gate.

A guard 20 is provided for protecting the films 17 which pass across the exposure openings facing a recess 19 (Fig. 2). This guard has a substantially U-shaped cross-section. It differs from the guard hitherto known in that it is provided with two extensions 20*a* and 20*b* on each lateral surface of the magazine as well as with a lateral enlargement 20*c* which upon the displacement of the guard 20 in one direction wholly or partly covers the recess 19 intended for the reception of the pressure plate and, therefore, prevents a false insertion of the magazine in the camera.

A similar enlargement of the guard may also be provided on the narrow side of the magazine in which the exposure openings are arranged, but it should only lie within the range of a longitudinal half of this narrow side. A guard thus designed uncovers only the exposure opening to be used. The part of the guard 20 lying on the other side of the magazine corresponds exactly to that shown in Fig. 2, i. e., the same view results if the magazine is rotated 180° about the axis C—D.

A sliding off of the guard 20 is prevented by elongated depressions 20*d* which guide the guard in similar elongated depressions 21 of the magazine covers 3 and 4 respectively. By means of a circular depression 20*e* which cooperates both in the central position shown and in both end positions with circular enlargements 21*a* of the depressions 21, a snap action is brought about in all these positions.

In the central position shown each of the supply film reels is locked by means of one of the arms 20*a* and one of the pins 13. If the guard 20 in Fig. 2 is moved to the left, the arm 20*a* slides off the locking pin 13, whereas the arm 20*b* is raised by a wedge-shaped projection 22 and on passing onto the locking pin 13 is brought out of engagement with the projection 22 so that the supply film reel which is not exposed to light is locked even if the film in the other magazine compartment is being used for taking pictures. A second wedge-shaped projection 22*a* permits when moving back the guard 20 in the central position the arm 20*a* to pass again onto the locking pin 13.

If, however, the guard 20 in Fig. 2 is moved to the right, the arm 20*a* is brought out of engagement with the locking pin 13, thus releasing the supply film reel; also the opening 19 for the film pressure plate is completely opened so that the film contained in the upper compartment in Fig. 1 may be exposed.

Fig. 4 shows another form of the magazine in which the exposure openings for both film compartments are arranged on the opposite narrow sides of the magazine. 23 denotes the film gate and 24 the film pressure plate. The portions of film 25 at the exposure openings are indicated by dot and dash lines. The numerals 26 and 27 indicate the supply film reels. A magazine thus designed must be rotated through 180° about a perpendicular axis when being inverted.

In the arrangement shown in Fig. 4 two guards of exactly the same size are preferably employed each of which encloses the entire magazine.

Fig. 5 shows another modified form of the guard adapted to be used for adjacent exposure openings of the two magazine compartments. One of the limbs of each guard 28 engages in a groove-like space arranged between both film compartments. By this arrangement it is possible as is the case with the arrangement shown in Fig. 4 to uncover only the corresponding exposure opening by displacing a guard and to release, if desired, the corresponding supply film reel.

Various modifications of my invention are possible without departing from the spirit of my invention. The magazine may be made of sheet-iron, die casting, pressed material or the like.

PAUL STORCH.

PUBLISHED	P. STORCH	Serial No.
MAY 4, 1943.	FILM MAGAZINES FOR CINEMATOGRAPH CAMERAS	122,145
BY A. P. C.	Filed Jan. 25, 1937

Fig. 1

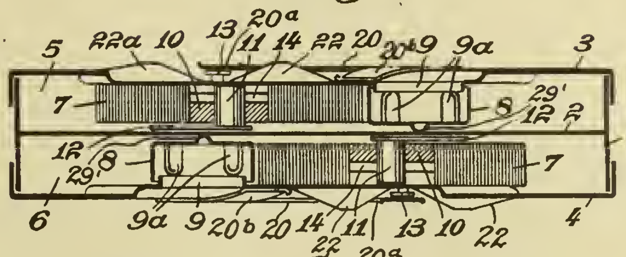


Fig. 2

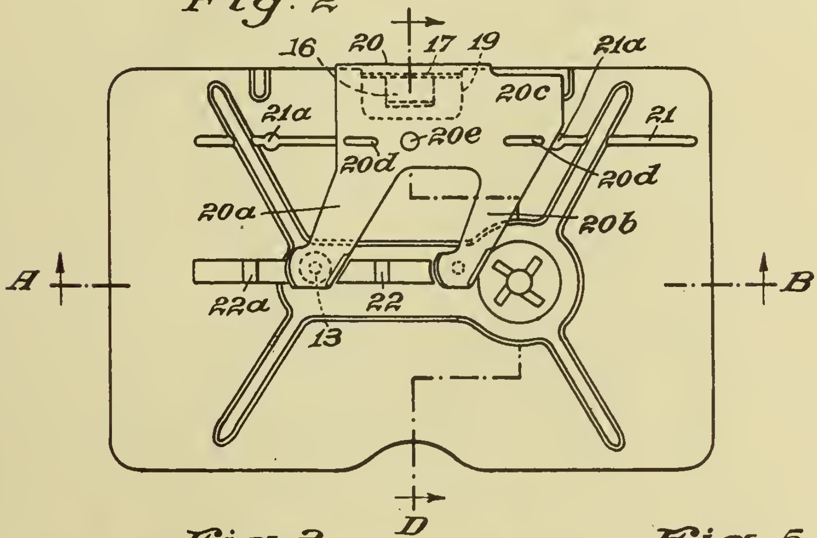


Fig. 3

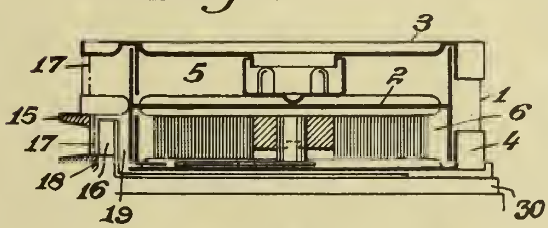


Fig. 5

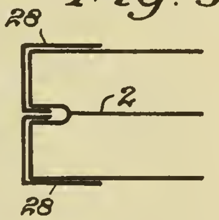


Fig. 4

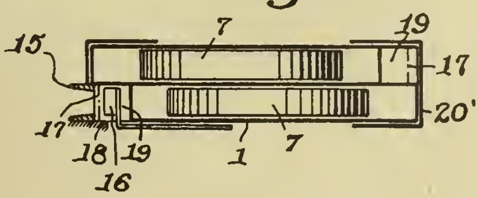
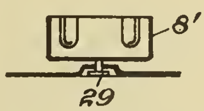


Fig. 6



Inventor
Paul Storch
by Knight Bros
Attorneys

Published May 4, 1943

Serial No. 159,854

ALIEN PROPERTY CUSTODIAN

CONTROL OF PAPER-MAKING MACHINERY

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Application filed August 19, 1937

My invention relates to means for controlling and regulating the pulp feed to paper-making machines, to mixing vats etc. It is an object of my invention to provide means for controlling and regulating the flow of the pulp fed into the machine, the vat or the like in a particularly simple and efficient manner.

I am aware that it is old to regulate the quantity of pulp fed to the machine by causing the pulp to pass an overflow arranged in front of a channel in which is arranged a separating slide for lateral displacement. The pulp entering the channel on one side of the slide is conducted to the machine, while the pulp entering the part of the channel on the other side of the slide is returned into the mixing vat. Obviously the position of the separating slide is responsible for the quantity of pulp fed to the machine.

In the practical operation of this device it has been found that it enables the pulp feed to be controlled and regulated in a very exact manner, which also allows creating absolutely uniform conditions of operation for the repeated production of paper of exactly the same weight by merely adjusting the separating slide. This possibility is due to the fact that the quantity of pulp required in the production of paper of a predetermined weight is exactly proportional to the division of the channel by the slide. No such simple relation to the quantity of pulp supplied exists with ordinary valves, throttles and the like, which are operated by a motor by way of remote control and are coupled with registration instruments, apart from the fact, that any throttling action gives rise to eddies which further influence the distribution of the pulp in an unfavorable manner. Furthermore the quality of the pulp, as compared with water, also influences the quantity of pulp passing through, and the viscosity of the pulp further influences the inner friction and wall friction to the extent of causing variations of the quantity of pulp issuing through the valves or throttles, while all these properties of the pulp have no influence on the distribution by means of a separating slide.

Owing to this circumstance the position of the slide clearly determines the distribution of the pulp about to enter the paper-making machine. I am thereby enabled to provide means for a remote control of the slide by means of a motor which can be operated from one or a plurality of stations remote from the machine, an indicating device at each station resembling the slide arrangement being arranged at each station and allowing the position of the slide in the channel to be ascertained and controlled in the simplest possible manner.

Obviously I am also enabled to couple the slide with means for controlling other conditions of operation of the paper-making machine, for instance the quantity of diluting water, the machine speed, the drying steam etc., which may be subjected to different variations, which may be carried out individually by hand. In these cases the simplicity of the slide control offers the possibility of locating the means for controlling other conditions at the control stations for the slide and to couple them in such manner that the change in the operations of the machine can be brought about quickly in a predetermined manner.

In the drawing affixed to the specification and forming part thereof two embodiments of my invention are illustrated by way of example in a purely diagrammatic manner.

In the drawing:

Fig. 1 is a diagram illustrating the feed channel and separating slide in combination with means enabling the slide to be adjusted by remote control.

Fig. 2 is a similar showing of an arrangement of two such controlling devices combined with remote control stations.

Referring to the drawing and first to Fig. 1, **1** is a pulp feed supply of considerable width and **2** is the separating channel extending in front of and below the pulp supply, being separated therefrom by the overflow **3**. **4** is the separating slide extending across the channel **2** and subdividing it into two parts **5** and **6**. From the part **5** of the channel the pulp flows to the paper-making machine, from the part **6** back to the mixing vat.

7 is an electro-motor operatively connected with and displacing the slide **4** by turning a screw spindle **8**. on which the slide **4** is mounted. **9** is a scale allowing to read the position of the slide at any individual moment. **10** is another electro-motor electrically connected with the motor **7** for synchronous motion. The motor **10** is located at a remote control station and drives a screw spindle **11** carrying a slide **12** with the pointer **13** extending above a scale **14**. **15** is a press-button switch for starting and reversing the motors.

Obviously the position of the slide **4** in the channel **2** can be read at any time on the scale **14** of the control station and the slide **4** can be shifted by operating the switch **15**.

Instead of an electrical connection a hydraulic connection may be provided between the motors for synchronous operation, and in certain cases even a mechanical coupling such as for instance a flexible shaft might transmit power from one spindle to the other. The scale **14** at the control station may differ from the scale **9** and in that case a step-up or step-down gearing may be provided for the pointer drive at the control station, for instance the spindle **11** may be threaded for a different pitch.

Fig. 2 illustrates a modified form of an arrangement embodying this invention, in which a pulp container can be disconnected and another pulp container connected to the pulp feed, as for instance in the case where during the production of the paper the color shall be changed, as will be the case with several small orders for the same kind of paper in different colors. In that case the pulp is fed to the paper-making machine first from one and thereafter from another container.

In that case two devices such as shown in Fig. 1 are provided, one for each container. Here the slide adjusting motors 16, 17 act by means of spindles 18, 19 on the two slides 20, 21 mounted for displacement in the channels 22, 23 arranged in front of the overflows 24, 25 respectively. The pulp from the parts 26, 27 of the channels passes through a common feed tube 28 to the paper-making machine, while the pulp from the parts 29 and 30 is fed through tubes 31, 32 respectively to two separate mixing vats.

With the motors 16, 17 are connected controlling motors 33 and 34 respectively, both mounted at a control station and driving in synchronism with the motors 16, 17 by means of spindles 35, 36 the pointers 37, 38 which indicate the position of the slides 20 and 21 respectively. Press-button switches 39, 40 are provided to start and reverse the motors. These switches may either be actuated separately or may be coupled with each other.

This arrangement allows gradually cutting out one and cutting in the other mixing vat or pulp container by shifting for instance slide 21 into the position shown in dotted lines, while at the same time the slide 20 is shifted in the opposite direction to cut in the other container. By thus operating the device the total quantity of pulp fed to the paper-making machine remains the same throughout and the attendant may concentrate himself onto the changing of the colors.

Similarly different kinds of pulp, for instance wood pulp and cellulose pulp may be fed from two separate containers in an exactly predetermined proportion to a mixing vat and the proportions may again be controlled and regulated from a remote control station. In accordance with the particular purpose in view such a device may be arranged in different manners. It may for instance resemble the arrangement illustrated in Fig. 2, being however operated in such manner that the two feed devices, instead of being operated alternatively, are made to operate simultaneously, feeding the different kinds of pulp in predetermined proportion.

The motors 7 or 16 and 17 may be fitted with circuit breakers which, if they are coupled with each other, also act on both motors and automatically determine the correct position of the newly started regulating device by cutting out its motor. After separation of the circuit breakers the motor may also be connected independently, the slide 20 (or 21) being shifted into a different position, for instance if the change of color is connected with the change in the weight of the paper or in the speed of the engine.

The two motors 16 and 17 may also be replaced by a single motor which should preferably be arranged between the two controlling devices and in that case drives both spindles 18 and 19. If one of the two controlling devices shall be operated separately, each spindle may be disconnected by itself. Together with the disconnection of the spindle the motor 33 or 34 controlling the respective device is stopped or, if only a single control motor should be provided at the remote control station, the spindle 35 or 36 is disconnected separately. In that case the couplings connecting the control devices are also under remote control, for instance by electromagnetic means.

A similar controlling and regulating device, which is also operated from the same remote control station, may also be provided for supplying diluting water to the pulp. Similarly the remote control devices for other operations of the paper-making machine, including the operating speed, the quantity of drying steam for the drying cylinders etc. may be combined at the same remote control station. It is further possible to couple the switches provided at the remote control station for certain cases in which the operation of the machine shall be changed. Thus, for instance, if in the production of a certain kind of paper the weight and all other properties shall remain unchanged, but the operating speed shall be raised, obviously all other factors must rise in the same proportion and in accordance to the rise in the production per unit of time also a greater quantity of pulp and diluting water must be supplied. Similarly more steam or current must be supplied to the power engines and more steam to the drying cylinders. On the other hand, if for instance with the same operating speed the weight of the paper produced shall be increased, the operation of the power engine remains unchanged, however the quantities of pulp, water and drying steam must be raised in even proportion. By coupling the corresponding switches at the remote control station these transitions from one to the other mode of operation are greatly expedited and facilitated and much time is saved. At the same time a saving in pulp is obtained since the waste otherwise produced in the interval is greatly reduced.

If the rise or drop of the different operations shall not occur in exactly uniform proportion, for instance if at uniform speed and a rise in the weight of the paper a more concentrated pulp shall be supplied and the quantity of diluting water reduced correspondingly, this can easily be effected by setting the circuit breaker for the diluting water from the beginning on that point of the corresponding scale which corresponds to the desired quantity of water, while the slide governing the supply of pulp is adjusted for a greater supply. In this example the same applies to the regulation of the quantity of drying steam if this quantity shall be reduced. If adjustable circuit breakers are provided for all operations of the machine, previous adjustment of the circuit breakers to the respective points on their scales will suffice to exactly predetermine the new conditions of operating the paper-making machine. If a separate motor is provided for each operation, the circuit breaker apportioned to it will act on it and if several controlling and regulating devices are driven by a common motor, the circuit breakers of two or all these devices will act on the respective coupling.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described for obvious modifications will occur to a person skilled in the art.

HERMANN PALM.

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H. PALM
CONTROL OF PAPER-MAKING MACHINERY
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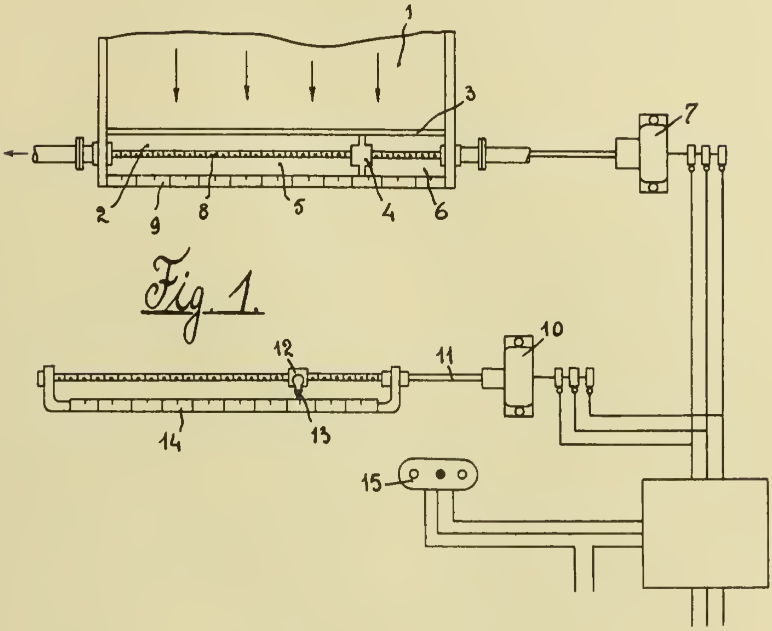

Fig. 1.

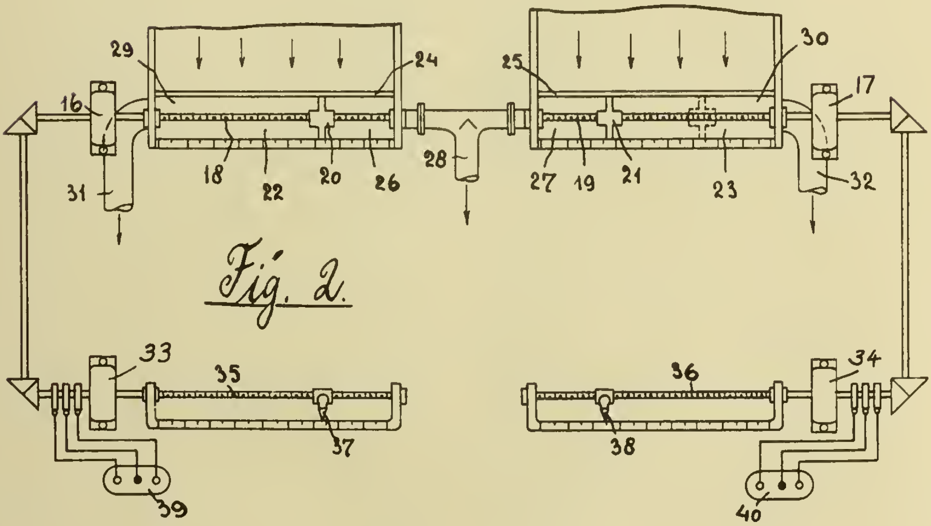

Fig. 2.

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ALIEN PROPERTY CUSTODIAN

KNITTING MACHINES AND METHOD OF OPERATING SAME FOR KNITTING FABRICS

Max Nebel, Chemnitz, Germany; vested in the Alien Property Custodian

Application filed September 16, 1937

This invention relates to knit goods and a method and device for producing same.

The two main groups of looped fabric, viz. warp goods and hosiery in the widest sense of the term, are well known. Warp goods afford the advantage of great changeability in the manner of connection and can be made extraordinarily close. Besides, it is extremely elastic and ladder-proof, though not so extensible as hosiery. This great transverse extensibility and elasticity so much desired in knit goods cannot be attained in warp goods to the desired extent, since the thread runs not in the direction of the courses as in hosiery but in the direction of the weals, or at least as in traverse warp goods, at an angle to the direction of the weals that is smaller than a right angle. This course of the thread causes undesirable extensibility in the direction of the weals, i. e. in the longitudinal direction of the goods. Furthermore, the production of warp goods involves numerous additional operations which have to be carried out before the actual knitting and which naturally render the finished goods more expensive. Warp goods, moreover, cannot be made regularly with firm edges and are always cut.

Hosiery, on the other hand, does not possess the same changeability as to connection and cannot be made as close as warp goods. The invention aims at combining the chief advantages of both kinds of goods in a new fabric, in which for this purpose the thread extends as in hosiery in the transverse direction of the goods, i. e. in the direction of the courses, to attain the high degree of extensibility, ladder-proofness and other advantageous properties of hosiery whilst the great elasticity, ladder-proofness and other good properties of warp goods are obtained by employing as in warp goods instead of sinker loops thread crossings or, so to speak, mesh shanks which extend from one needle loop of a course to the needle loop of a following course. It has been attempted already to obtain similar connections for hosiery goods as are found in warp goods, but in such instances only mesh shanks or meshes have been tied into the sinker loops of the following course.

According to the invention, needle loops of ordinary length and longer needle loops, or ordinary needle loops alone or long needle loops alone, are present in every course or in certain courses, and the long needle loops in the same weal or in a weal laterally arranged therefrom in the following course are formed together with a needle loop of ordinary length or alone into a needle loop, whilst one of the two shanks of the longer needle loop is tied only into one of the needle loops preceding the needle loop of ordinary length.

For producing the hosiery according to the invention the procedure is further such that the mesh portions disposed between and above the needle loops are worked longer than usual and than the top loop portions of the meshes, so that during looping in a following course these mesh portions can be drawn through the needle loops of the course in which these mesh portions are formed or drawn through the needle loops of a following course and in the next course can be made into needle loops in the same weal or in a weal arranged laterally therefrom. The needle loops that are longer than usual may be formed into a needle loop either alone or together with the ordinary needle loop of the course concerned. The mesh portions located between the needle loops are worked in the width over one or more divisions.

By way of example, different connections of the goods according to the invention and several modes of application of methods of producing such goods are illustrated in the accompanying drawing, in which

Figures 1 to 10 each show a special connection of the goods;

Fig. 11 shows plated goods according to the invention;

Figs. 12 and 13 each show goods with tied-in wefts;

Figs. 14 and 15 show hosiery of known type to explain the development of the loop connection in the goods according to the invention;

Fig. 16 shows the fundamental principle of loop connection in goods according to the invention.

In the following figures which show machines or parts thereof for the application of the various methods the row of sinkers and needles, in so far as circular knitting machines are concerned, is shown rectilinearly and not circularly or in the form of an arc in both the top and front views for clearness' sake. The front view is taken in the direction of the back of the needles, i. e. in circular knitters from inside the needle cylinder. All following front views and top views show a complete looping process from beginning to end and up to the beginning of the next looping process.

Figs. 17 and 18 are, respectively, a front and top view of a section of the needle and sinker plate of a circular knitter for producing goods according to the invention, the sinkers moving in the direction of the back of the needles and both partial courses being formed during a looping operation;

Figs. 19 to 26 are side views of certain needle and sinker positions of sections on the lines **19—19, 20—20, 21—21, 22—22, 23—23, 24—24, 25—25** and **26—26** in Figs. 17 and 18 and also in some figures named below, which illustrate other methods;

Figs. 27 and 35 are front views of a method applied to circular knitters, wherein the sinkers

are moved toward the needle breast or bulging portion of the needle shank;

Figs. 28 to 34 are side views of certain needle and sinker positions and ef thread positions of sections taken on the lines 28—28, 29—29, 30—30, 31—31, 32—32, 33—33 and 34—34 in Fig. 27.

Fig. 36 shows the application of a method in a circular knitter, shown in front view, in which the sinkers move in the direction of the back of the needles and both partial courses are formed during one looping process;

Figs. 37 to 40 are sectional side views on the lines 37—37, 38—38, 39—39 and 40—40 in Fig. 36;

Fig. 41 is a front view of a circular knitter showing a method according to which the sinkers move toward the needle backs and both courses are formed during one looping process;

Fig. 42 is a front view of a circular knitter and shows another application of a method according to the invention, in which the sinkers move toward the needle backs and both partial courses are also formed during a looping process;

Figs. 43–44 are sectional side views on the lines 43—43 and 44—44 in Figs. 42 and 43;

Figs. 45 and 46 and 47 and 48 are, respectively, front and top views showing the application of a method, in which both partial courses are formed in two looping operations;

Figs. 49 to 51 are sectional side views of certain needle and sinker positions according to Figs. 45 to 48 on the lines 49—49, 50—50 and 51—51 of these figures and of some others which show other methods;

Fig. 51ª is a side view of a special thread position to insure correct needle position for the different methods to be explained below, this needle position being referred to as "catch position;"

Figs. 52 and 52ª and 53 and 53ª show the application of one of the methods according to the invention to a flat or straight bar knitting machine, in which the sinkers move toward the needle backs. Figs. 52 and 52ª show looping in one working direction and Figs. 53 and 53ª in the other, only one partial course being formed at each looping.

Figs. 54 to 57 are side views of needle and sinker positions and thread positions according to another method;

Figs. 58 and 59 are, respectively, a front and top view of the application of another method according to which both partial courses are formed in one looping operation and the sinkers are moved against the needle backs;

Fig. 59*a* is a sectional side view of Figs. 58 and 59 and the following Figs. 60 and 62 on the lines 59ª—59ª, of Figs. 58 and 59 and of Figs. 60 and 61;

Figs. 60 and 61 are, respectively, a front and top view of the application of another method;

Figs. 62 and 63 each show a pattern wheel;

Fig. 64 shows a drive for a pattern wheel;

Fig. 65 shows a special operating position of the needle relative to a sinker during reverse plating of goods according to the invention;

Fig. 66 is a plan on the line 66ª—66ª, of Fig. 65;

Figs. 67 and 68 are, respectively, a front and top view of the application of a method, in which the sinkers move toward the needle breast, only one partial course being formed during a looping process;

Figs. 69 and 70 are sectional side views on the lines 69—69 and 70—70 of Figs. 67 and 68;

Figs. 71 and 72 are, respectively, a front and top view of the application of a method according to which both partial courses are formed during one looping operation;

Figs. 73 and 74 are sectional side views on the lines 73—73 and 74—74 of Figs. 71, 72 and the following Figures 75 and 76;

Figs. 75 and 76 are, respectively, a front and top view of the application of a method according to which only one partial course is formed during each looping operation;

Fig. 77 is a front view of the application of a method, in which nooses are laterally hung over and formed alone into a needle loop and only one partial course is formed at each looping operation;

Fig. 78 shews goods according to the invention provided with plush loops;

Figs. 79 and 80 are, respectively, a front and top view of the application of a method for producing loop-plush goods according to Fig. 78, in which both partial courses are formed during a looping operation;

Figs. 81 and 82 are lateral views of two working positions of the needles relative to the sinker in the application of a method to machines having two rows of needles and sinkers in one needle row, which move toward the backs of the needles of the other row;

Figs. 83, 84 and 85 show in front view different possibilities of arranging the sinkers shown in Figs. 81 and 82 in one of the needle rows;

Figs. 86 to 90 are side views showing different working positions of spring needles relative to sinkers one of which moves toward the needle breast and the other toward the needle back;

Figs. 91 to 94 show in side view the same possibilities of the application of a method according to the invention as Figs. 86 to 90, with the difference, however, that latch instead of spring needles are used; and

Fig. 95 is a side view of a position of a spring needle with the sinkers moving toward the needle breast in the application of the method according to the invention.

In view of the possibilities of producing the goods according to the invention described below it is pointed out, in order to better understand the connection provided by the invention, that one proceeds from two ground connections of knit goods. In the first place, there are two threads *a* and *b* (Fig. 14) in a course all loops of which lie in two partial courses on a straight line L—L, and the two threads *a* and *b* are alternately made in needle loops A and B, whilst the sinker loops C are formed half by the thread *a* and half by the thread *b*. In this kind of goods the needle loops of a course always consist of one thread, alternately *a* and *b*, and the thread portions *e* and *d* of the threads *a* and *b*, which have not been formed into loops A and B, are so arranged behind the needle loops A and B, alternately formed of the thread *a* or *b*, as unfinished loops *e* and *d* that every second loop *d* of a course covers the ends of the loops *e* laterally arranged therefrom. This change 1+1 in the formation of the needle loops from one of the threads *a* and *b* and this relative position of the loop portions *d* and *e* occur in every weal.

The other starting connection is shown in Fig. 15. This fabric also consists of two threads *a* and *b*, but all loops A formed of the thread *a* lie on the straight line M—M and all meshes B formed of the thread *b* lie on the line N—N which is positioned parallel to the partial course, i. e. the line M—M, of the loops A.

In the partial courses M—M and N—N both threads a and b are made into needle loops A and B and into partial loops e and d in such manner that the parts d and e do not cover each other and the change in forming loops A and B from threads a and b, which is present when both partial courses are considered together, does not occur in the weal.

From these two known fundamental connections the goods according to the invention are developed as follows:

The two incomplete loops e and d are made longer than in the known connections, approximately as long as shown by dots and dashes in Figs. 14 and 15 and designated **3** or 3^a, 3^b in Fig. 16. These longer loops **3** are made in the next course together with a needle loop A or B, which as needle loop of ordinary length is subsequently designated **4**, into a long needle loop **5**.

In the initial connection shown in Fig. 14, wherein the partial courses formed of the loops A and B lie on a line L—L, several connections according to the inventions are represented by a thread in sold black. One loop **5** of the black thread is in the weal together with the needle loop A or **4** of the following course made into the needle loop **5** above which it would lie as thread member d or e in the initial connection. This manner of connecting is characterized in the following description by the words, "that the longer loops **3** in the same weal are made in the following course or next but one into long needle loops **5** together with the needle loop **4** of ordinary length".

The other mesh **5** of black thread in Fig. 14 is not worked in the same weal into a needle loop in the next course but in a weal that is laterally arranged therefrom. This lateral hanging over of the long loops **5** naturally requires somewhat more thread than does the long needle loop **5** which is worked into a needle loop in the same weal in the next course, as indicated by the unfinished loop 3^d, shown in dots and dashes, of the laterally hung over needle loop **5**, which is somewhat longer than the other member **3**. In a special kind of the goods according to the invention the long loop members **3** can be made also alone into long needle loops **5** in a following course.

In the initial connection shown in Fig. 15, wherein the two partial courses formed of the loops A or B lie on two straight lines M—M and N—N, the connections according to the invention are also indicated by two threads a and b in solid black. The new connection shown in Fig. 14 by the black thread can be made also in the goods shown in Fig. 15, and vice versa.

Fig. 15 shows the loop e made of the black thread b, the loop e or **3** being longer than in the initial connection and in the adjacent weal of the meshes A worked in the following partial course into the longer needle loop **5** together with the mesh A. For better distinction this loop **5** is designated 5^x. In the other black partial course of thread a, whose loop d in the initial connection is formed into a longer loop **3**, this loop **3** is made in another direction than loop 5^x in the adjacent weal B into the long needle loop 5^y together with the mesh B of the following partial course.

The long needle loop 5^z also shown in Fig. 15 and made of the black thread a is in the following partial course and in the weal disposed laterally of the initial weal B made into a loop with the mesh B, subsequently referred to as **4**.

In the ground connections described and shown in Figs. 14 and 15 the mesh shanks or loop portions producing crossings according to the invention are formed of the thread portion which extends from the long needle loop **5** to its associated ordinary needle loop **4**, the needle loops made of the thread a being designated $5a$ and those made of thread b, 5^b. As indicated in Fig. 15, from the ordinary loops of a course formed of the threads a or b loop shanks 5^a or 5^b extend as portions of the long needle loops made of the same thread to a following course.

These various ways of laying thread and making connections while starting from different initial connections may be combined at will. Examples of such combinations will be described below, and it is pointed out that for each connection described an equivalent warp fabric connection is available, with the difference, however, that in the examples of fabric according to the invention the thread extends in the transverse direction of the goods.

The general procedure is such that the thread portions lying between the needle loops and worked longer than usual are drawn during looping of a following course through the needle loops of the course in which the loops are formed or through the needle loops of a following course and then formed in the next course, in the same weal or one laterally arranged therefrom, into needle loops.

The loop formation shown in Fig. 14 is produced as follows starting from Fig. 16:

1. *Looping step.*—The thread a of needles N^1 is placed behind the needle head and under the needle head of needles N^2, whereupon the thread b is placed behind the head of needles N^2 and under the head of needles N^1.

Both threads are sunk to form longer loop portions **3** and needle loops of ordinary length (Fig. 14). As each thread is sunk from every other needle, the loop portions **3** have the width of twice the needle division. The loop portions **3** are drawn out so much longer than usual that enough thread is available for finishing the long needle loops **5** in the next course, which are twice as long or even longer than ordinary needle loops **4**. The various loops formed of the threads a and b are designated 3^a and 3^b in Fig. 16. The loops **3**, 3^a, 3^b are after the sinking step when the needles ascend again brought over and beyond the needle head under the hook, which is made possible by the fact that the loops 3^a and 3^b each extend over a division in width.

Hanging over according to Fig. 16 is as follows: Loops 3^a over needles N^1; loops 3^b over needles N^2.

The portion **2** which is drawn from the long drawn out loop through the old mesh **4**, **5** becomes the ordinary loop **4** whilst the other portion which owing to the higher sinking point holds more thread forms the long loop **3**. There are two sinking edges, the ordinary one and a second one located above the ordinary edge, the higher edge serving for sinking and the ordinary edge for finishing and knocking over.

After the hanging over step the needles N^1 and N^2 ascend farther into pressing position. This pressing step is carried out as follows:

The meshes **4** and **5** which were on the needles already before hanging over took place are pressed off as usual, i. e. these old meshes are placed below the latch on the needle shank to be knocked over during the next looping operation by sliding during the following sinking step over the

closed latch and being thrown off from the needles. The loops **3** that have been hung over are not pressed and remain below the hook on the latch until the next sinking operation.

2nd loop formation.—This next sinking operation starts by placing the thread a from the needles N^2 under the needle head N^1. The thread b is placed from the needles N^1 under the needle head N^2.

The loops **3** drawn from the threads a and b are during the sinking operation together with the loops **3** of the first sinking operation that are not pressed off (first looping step) under the hook and, together with the new needle loops **2** which are made into ordinary loops **4**, are worked into long needle loops **5**.

It follows from both looping steps that from the ordinary loops **4** of a course, formed of the same thread a or b, loop portions or shanks 5^a or 5^b extend to the long needle loops **5** of the following course and connect needle loops of one course with the needle of a following course instead of the ordinary sinker loops in goods in which the needle loops of a course are connected by sinker loops. In this way, instead of a sinker loop cross threads are formed as seen in the goods shown in Fig. 16.

3rd looping step.—Then follows the next sinking operation, during which the thread a is placed behind the head of the needle N^2 and under the head of needles N^1 whilst the thread b is placed behind the head of the needle N^1 and under the head of the needles N^2.

4th looping step.—During the fourth sinking operation the thread a is placed behind the head of the needles N^1 and under the head of the needles N^2, whilst the thread b is placed behind the head of the needles N^2 and under the head of the needles N^1.

The 5th looping step resembles the preceding one and the sixth step is similar to the second.

This process yields a fabric in which the loops are positioned as in the basic connection shown in Fig. 14.

To produce goods showing the connection according to Fig. 15 one proceeds as follows:

1. Sinking operation as described for the first looping step; 2nd sinking operation as in the second looping step; then again as in the first sinking operation, followed by the second sinking operation, and so on.

In the goods shown in Figs. 1 and 2, each loop comprises two threads a and b and a long and a short mesh, the long mesh **5** being worked together with the short mesh **4** of the next course to form a needle loop.

In the fabric according to Fig. 1 all loops lie on a straight line **2—2** in accordance with the fundamental connection shown in Fig. 14, in the manner of ordinary knit goods, whilst in Fig. 2 the loops lie on two straight lines N—N and M—M according to the fundamental connection shown in Fig. 15.

In both fabrics instead of sinker loops thread crossings are produced and thus both goods externally resemble the diagram of mesh formation of the known traverse warp goods.

The method employed is indicated in Figs. 17 to 26.

There are two needle groups N^1 and N^2 guided in two cams, and the needles N^1 are longer than the needles N^2. The heel of the long needles N^1 is designated N^{1x} and that of the shorter needles N^2, N^{2x}. As indicated in Figs. 17 and 18 and the side views **19—26**, particularly in Figs. 19, 20 and 21, both needle groups are moved differently. At each sinking operation two threads a and b issuing from the thread guides **1** and **2** are worked. The needles of group N^1 move below the thread guide **1** and past it and ascend so high that their head moves above and past the guide **2**. To insure reliable placing of the threads behind the needle heads the latter preferably are bent somewhat toward the thread guide, as indicated in Fig. 19. Through the needle motion mentioned the thread a is brought behind the heads of the needles N^1 and the thread b under the hook N^1. The needles of the group N^2 move with their heads above and past the thread guide **1** and then descend to pass below the thread guide **2**. In this way, the thread a is brought under the needle hook N^2 and the thread b behind the needle head N^2. Out of their elevated position (Fig. 24, pressing position) the needles of both groups, before passing into their operating position relative to the thread guides as described, are preferably moved down a certain extent, so that when the sinkers leave the needle row (Fig. 25) the loop **3** lying on the open latch cannot slip off from the latch, as it would then hang upon the needle shank without the necessary distance from the old mesh **4**, **5**. Furthermore, the needle heads must pass as closely as possible above and below the thread outlet of the guides, so that the latch always remain as separating member between the loops **3** and the old meshes **4**, **5**, as shown in Figs. **19** and **28**. The sinkers P, moved by cams of known type, enter in the direction Z between the two thread guides **1** and **2** (Fig. 18) and pass toward the needle back through the needle row and under the threads a and b to such an extent that, as indicated in Fig. 19, the threads during the sinking of both needle groups N^1, N^2 are placed on the sinking edge P^a of the sinkers P. This edge P^a is arranged so much higher than usual (Fig. 17) that the loop is drawn out as required to give the longer loops between the needle loops **4** so much more thread than usual to enable them to be worked in the next course into the loop **5**. The loop **3** will then be so positioned that the loop 3^a of the thread a lies above the two sinkers P between the needles N^1 and above the needles N^2 and the thread 3^b above the sinkers between the needles N^2 and above the needles N^1 (Figs. 17 and 18). During this sinking of the loops on the edge P^a finishing of the loops on the ordinary sinking edge K is effected, which lies underneath the lower sinker edge P^c. The goods hanging on the needles lie on the edge K.

The sinking depth can be adjusted by vertically adjusting the sinker bar or by sinking the needles correspondingly or, which is particularly advantageous, by varying the position of the two loop-forming tools, sinkers and needles, in such manner that the needles below the ordinary sinking edge K (Fig. 21) go down lower than usual and the sinking point for the loop portions is raised by raising the sinkers P and thereby their edge P^a.

After sinking of the long loops, as indicated in Figs. 20, 17, 18 and 21, the sinkers P prior to the ascent of the needles move farther in the direction Z toward the needle backs until the long unfinished loops **3** which are each carried by two sinkers, are brought forward by the throat P^b to such an extent (Fig. 22) that the ascending needle passes through the loop (Fig. 23). The long loop is thus transferred to the needle (Fig. 23) and lies below the hook. After this transfer the sinker moves back somewhat in the direction V

to permit the loop to lie within range of the needle hook (Figs. 23 and 18).

To permit the placing of the hung over loop **3** under the hook care must be taken that the latch of the needle is open already when it moves out of the sinking position (Figs. 21 and 29) into hanging over position (Figs. 22 and 30). This opening of the latch can be effected by known means, for instance by using a latch opening brush in machines in which the sinkers are moved toward the needle back or by employing latch needles in which the latch guide slot is not slotted toward the needle back, so that the latch when a loop passes over it is elastically held in closed position and opens when no pressure is exerted upon it any more.

The most usual procedure is to have the latch opened by the old loop when the needle is moved up after sinking, and this method can be used also in connection with the invention if the latch is so short (Figs. 91 and 92) that it will be opened by the old mesh **4, 5** already before the needle head during motion of the needle from sinking position (Fig. 91) into hanging over position (Fig. 92) passes through the loops **3** pushed in front of the head on the sinkers P.

When the needle moves into highest position, i. e. pressing position (Figs. 17, 18 and 24), the sinker is still in the needle row to such an extent that the long loop still lies on the edge P^a and on the open latch and the old meshes **4, 5** are separated by the lower edge P^c from the hung over loops **3**, so that during pressing when the old mesh slides from the open latch owing to the ascent of the needle onto the needle stem the new loop **3** is not placed below the opened latch on the needle shank. This pressing position is the highest needle position from which it moves down again whilst the sinker passes out of the needle row in the direction V (Figs. 17, 18 and 25). When the sinker separating the old and new loops is moved out of the needles, the latch takes care of separating the old from the new loop even if at the beginning of a new sinking operation the sinker moves again between the needles (Fig. 26). To prevent damaging or displacement of the loops **3** by the sinker the lower edge P^c of the sinker P is bevelled at the free end of the sinker in such manner that the lower edge P^c forms a point with the upper edge P^a.

The next sinking operation is initiated as the first one with the difference, however, that the thread *a* is brought under the head of the needles of group N^1 and behind the head of the needles of group N^2, whilst the thread *b* is brought under the head of the needles of group N^2 and behind the head of the needles of group N^1 (Fig. 19). During the sinking operation the loop **3** lying on the open latch together with the freshly sunk needle loops is drawn through the mesh **4, 5** (which is still on the needles, Figs. 20 and 21) of the preceding course and formed into a new loop **3**.

The old mesh **4, 5** is thrown off over the needle head, as indicated in Figs. 20 and 21. The loop **3** is then hung over again so as to lie in front of the head below the hook (Figs. 22, 23), and in this way the fabric shown in Fig. 1 is produced.

Production of the goods shown in Fig. 2 involves the same operations, the only difference being that the motions of the needle groups N^1, N^2 are not changed from one sinking operation to another. It is therefore essential that as in the method of production shown in Fig. 1 and described above two threads are alternately brought in front of and behind the heads of the needles of both needle groups N^1 and N^2 during a sinking operation and, further, that the needles of the group in which the thread issuing in working direction is to be brought behind the needle head rapidly ascend directly behind the first thread guide to insure safe placing of the thread, since the thread issues in a curve toward the needle which thus has to move up behind this thread curve, as shown in Figs. 17 and 18, wherein one needle path is designated by dotted lines and the other one by dash and dot lines. The needle group N^1 places the thread *a* and sinks the thread *b*, whilst the needle group N^2 places the thread *b* and sinks the thread *a*.

The needle designated N^{1z} moves directly behind the thread guide **1** whose thread *a* is to pass behind the heads of the needles N^1 and rapidly passes into the position of the needle N^{1y} (Fig. 17). Fig. 18 clearly shows how the thread *a* issues in a curve from the guide *a*, so that the needles N^{1z} can safely push up behind.

The group N^2 which has to place the thread *b* passes after placing the thread *a* under the needle head gradually down into sinking position and thus below the thread outlet of the guide **2** and beyond the latter (dotted line), so that the thread *b*, which is taken by the ascended needle of the other group N^1 under the hook, cannot be caught by these needles N^2 and is thus placed behind the needle head.

To bring the thread outlet as closely as possible to the needles the thread tube is bevelled in known manner towards the operating direction R, Figs. 17 and 18, whereby also the curvelike issue of the thread from the guide is facilitated.

The application of the method described does not depend upon the motion of the sinkers in the direction of the needle backs. The better known and more customary motion of the sinkers in the direction of the needle breast is suited also.

The other methods to be described below may also be carried out on such machines, except goods with laterally overhung connections and goods with wefts.

Figs. 27 to 35 show the most important working positions. The novelty is that three sinkers are guided in one cut instead of one or two which move between the needles. Every third set of sinkers comprises two sinkers of novel shape, hook sinkers **15** (Figs. 35 and 27), which are disposed between two covering sinkers **16** whose noses **16**^{a} cover the hook **15**^{a} of the sinkers **15**. The upper edge **16**^{c} of both covering sinkers **16** is on a level with the upper edge **15**^{c} of the sinkers **15**. The hook **15**^{a} projects from this edge and serves for drawing the floating thread portions of each needle, which extend for instance from one needle to the next but one, forward beyond this needle when it is in sinking position (Figs. 29 and 30) to such an extent that during ascent of the needle the floating portion is positioned on the side of the needle breast and is brought under the needle hook. The covering sinkers serve for covering the hooks when the sinkers move out of the needle division, so that the floating thread portion is lifted without trouble on the upper edge of the nose **16**^{a} rising up to **16**^{b} over and beyond the hook **15**^{a}. Both sinkers **16** always act jointly. The sinkers **15** are independently movable and are driven in known manner by special cams.

The mode of operation is as follows: Two needle groups N^1 and N^2 are working again which alternately place the thread *a* or *b* under the needle hook or behind the needle head in the same manner as described with reference to the method for producing goods as shown in Figs. 1 and 2.

Fig. 28 shows in section on the line **28**—**28** of Fig. 27 sinkers in inoperative position and the laying of the thread *a* or *b* under or behind the hook, Fig. 28 showing that the thread *a* has been brought under the hook of the needle N^1 and behind the head of the needle N^2. The curve-like issue of the thread from the guide **1**, whereby the placing of the thread behind the head of needle N^2 is made possible, is not indicated in this figure. The position of the thread guide and the course of the thread are the same as in the previously described method (Fig. 18). On the path limited by the thread guides **1** and **2**, Fig. 27, all three sinkers jointly move through the division and below the thread *a*, so that also the subsequently laid thread *b* like thread *a* passes over the sinker backs **15**^{c} and **16**^{c} behind the hook **15**^{a} or hook covering nose **16**^{a}, but knocking over position is not reached. When the needle sinks (Figs. 27 and 29), the new loops are sunk longer than usual. Whilst the needle begins to pass out of the sinking position into upper position (Fig. 30), the covering sinkers move in the direction Z into knocking over position. During this motion of the covering sinkers the hook sinker **15** moves alone out of the needles in the direction V and draws back the loops lying over one needle and the backs of two sets of sinkers **15**, **16**, **16** far enough that the thread is placed on the breast side of the ascending needle. When the needle has risen so high that the loop under the hook is positioned on the needle breast side, the hook sinker moves in the direction Z until the loops leave the hooks (Figs. 31 and 27). All three sinkers **15**, **16**, **16** remain in the position shown in Figs. 31 and 27 during the locking in operation. When the needles ascend farther into pressing position, the covering sinkers move into the position shown in Figs. 32 and 27, so that the hook **15**^{a} is covered by the nose **16**^{a} and the loop **3** is disposed along the incline **16**^{b} under the hook **15**^{a}, as shown in front view in Figs. 35 and 27. During the pressing operation the covering noses **16**^{a} separate therefore the old meshes **4**, **5** on the shank of the needle from the long transferred loop **3**, so that the meshes **4**, **5** are kept below the open latch on the needle shank and the loop **3** remains lying on the open latch. (Figs. 32 and 27).

When the needles descend after pressing, all three sinkers **15**, **16**, **16** jointly move out of the needle row in the direction V. The loop **3** is thus absolutely freed from the sinkers and hangs only on the needle below the hook while lying on the open latch (Figs. 33 and 27), so that, as shown in Fig. 34, when the descent of the needle begins again and the operations according to Figs. 28 and 27 start again, the latch closes and the loop is worked into a mesh together with the new thread to be sunk.

The covering nose **16**^{a} has an inclined edge **16**^{s} extending from the point downwardly to prevent during advance of the sinkers into operating position the loops **3** from being damaged or displaced. The change in operation of the needle groups relative to the thread guides is the same as described before, and the method is like the previously described one and merely employs new means like the new sinkers and novel relative motions of the sinkers and needles.

The goods to be made are restricted to those in which the long loops are worked into needle loops either alone in the same well and in the next course or together with the shorter loops of this course. Weft fabric, too, cannot be made, since the sinkers moving toward the needle breast prevent the insertion of a weft thread.

According to the method just described two needle groups N^1 and N^2 are so operated that both groups during one and the same sinking operation simultaneously work both threads *a* and *b* alternately into ordinary and longer loops and hang them over. In the production of all kinds of goods according to the invention this method may be altered so that at one system only one needle group N^1 or N^2 sinks only one thread to form ordinary and longer loops and hangs them over after this sinking operation, or hangs over only after the sinking operation following this first one, whilst the other needle groups, i. e. the needles in between, are not participating in the sinking motion and the old meshes remain on these needles. This group works only at the next system, so that at the first system needle group N^1 works and N^2 is inoperative, second system needle group N^2 works and N^1 is inoperative, and at the third system needle group N^1 operates and N^2 is eliminated, etc.

The change may also be such that at the first system group N^1 operates and N^2 is eliminated; at the second system, group N^2 operates and N^1 is eliminated; at the third system group N^2 operates and group N^1 is eliminated; at the fourth system group N^1 operates and group N^2 is eliminated; at the fifth system group N^1 operates and N^2 is eliminated; at the sixth system group N^2 operates and N^1 is eliminated, etc.

At uniform change of the working needle groups in the sequence N^1, N2, N^1, etc. (shown in Figs. 75 and 76 without working in a weft) the needles N^1 first work in the operating direction R, that is, in the drawing, from right to left, the meshes **4** and the long loops **3**^{a} from the thread *a*, and the needles N^2 move in the meantime through this system, the relative position of the sinkers and needles being shown in Fig. 21. The long loops between the needles N^1, which hang on two sinkers P, extend over the needles N^2 disposed between every two needles N^1. The needles N^2 pass from the position shown in Fig. 21 gradually up into hanging over position, the relative position of the sinkers and needles being shown in Figs. 22, 23, 75 and 76, when the long loops **3**^{a}, as indicated in Fig. 23, are transferred to the needles N^2. Then follows the pressing position at which the relative position of the sinkers and needles will be like that shown in Fig. 24, when the previously transferred loops **3**^{a} remain on the open latches and the old meshes **4**, **5** are placed under the latch, i. e. are pressed off. After pressing the needles N^2 pass into sinking position, Figs. 75 and 76, and the transferred loops **3**^{a} are kept separate from the old mesh **4**, **5** by the latch, as indicated in Figs. 25 and 26. The thread *b* is drawn out into ordinary loops and longer loops **3**^{b}. During this sinking motion of the needles N^2 the needles N^1 move through this system at the elevated position shown in Fig. 21. This position has been taken by the needles N^1 immediately after their sinking operation in the preceding system. During sinking of the needles N^2 the long loops lie between the needles N^2 over and beyond a needle N^1. When the needles N^1 move into pressing position, hanging over of the long loops **3**^{b} and working out with the newly sunk loops occur on the needles N^1. The first-described operation of the needles N^1 is now repeated, so that the group N^1 alternates in the manner described with the group

N^2, whereupon N^1 alternates with N^2, and so forth, as seen in Figs. 75 and 76.

At each system needle groups can be sunk and meshes formed and plated goods in known manner be worked only in such manner that, as indicated in Figs. 45, 46, 47 and 48, the thread guide **1**, shown in dotted lines, lays the ground thread *a* and the thread *b* issuing from the guide **2** is laid as plating thread.

When the groups change in the sequence N^1, N^2, N^2, N^1, N^1, N^2, N^2, N^1, etc., the mode of operation of the loop-forming tools differs in so far as each needle group successively carries out two sinking operations.

This method is shown in Figs. 45 to 51. On all needles N^1 and N^2 the long loops 3^a and 3^b of the partial courses formed of the threads *a* and *b* are hung over before the sinking operation to be described begins. The needle N^1 gets the thread *a* from the guide **2**, sinks it to form ordinary and long loops, whilst the needle N^2 is inoperative (position as shown in Figs. 20, 21) and works the previously transferred loops 3^a during sinking of the mesh **4** into the loop **5**, as indicated in Figs. 20, 21. The newly sunk loops 3^a are not transferred by the sinkers P (Fig. 46) to the needles N^2, when the latter move up after the sinking of the needles N^1, because the needles N^2 still hold the old transferred loop 3^a together with the old mesh **4**, **5** (Fig. 50). To work always only one long loop, the long loop is not transferred over the needle head according to Fig. 22, but, as indicated in Figs. 50 and 46, the sinkers remain in sinking position until after the next sinking operation (Fig. 48), so that the needle N^2 goes up in front of the loops 3^a on the sinkers P, though not as high as required for pressing, but only as high as shown in Fig. 45, so that the old transferred loops do not lie below the open latch on the old mesh (Fig. 50). During the next sinking operation (Figs. 47 and 48) the needles N^2 work the thread *b* issuing from the guide **2** into loops **4** and long loops 3^b and the old loops 3^b into loop **5**. During working of the needles N^2 the needles N^1 remain in the low position shown in Fig. 49 and on line **49—49** of Fig. 45. After the needles N^2 have finished their work (Figs. 47 and 48) all old loops on the needles together with the newly sunk ordinary loops **4** of the threads *a* and *b* are worked by the needles N^1 and N^2 into loops **5**. The new loops 3^b worked in the preceding system by the needles N^2 and the new loops 3^a still earlier formed by the needles N^1, which are not transferred as described (Figs. 50 and 46), are, as indicated in Figs. 47 and 48, prior to the third sinking operation like the loops found over all needles N^1, N^2 brought into pressing position before all needles N^1 and N^2 go up, the position of the tools being shown in Figs. 22 to 24. From the pressing position all needles move out again, and the needles N^2 which are going to carry out a sinking operation move into sinking position and work the thread *a* (Fig. 47) and otherwise repeat the operations described. The other needles N^1 move down before the thread guide into catch position (Fig. 51, line **51—51** in Fig. 47) where the needle is so positioned that the loop 3^a lies under the needle head and the closed latch and the old mesh **4**, **5** on the closed latch. The needle should not be so low that the old mesh can be thrown off over the needle head, since during re-ascending the old meshes, as shown in Fig. 50, lie again under the latch and the loop on the open latch.

This position is occupied by the needles which after all loops have been hung over on all needles are eliminated from the next sinking operation.

Figs. 67 and 68 show another mode of operation.

In the method described just now the long loop is sunk behind or over the needles and after sinking during ascension of the needles brought before the needles by the sinkers and transferred to them. It is further possible, as shown in Figs. 67 and 68, 69 and 70, to sink long loops and to work them during the next sinking operation together with the new ordinary needle loop into a loop in the following manner. Every other needle N^1 sinks a thread *a* issuing from the guide **1**, but during this sinking of the needles N^1 the other needles N^2 do not pass into low or catching position. On the contrary, they pass at such a high position through the sinking point (Figs. 67 and 69) that the long loops 3^a lie already during sinking above the sinker edge P^a on the open latch below the needle head of these non-sinking needles N^2 (Fig. 69). After the pressing operation following this sinking of the needles N^1 press off as usual, because they have no long loops, whilst the needles N^2 with long loops can participate in the pressing motions of the needles N^1, but, as shown in Fig. 70, ascend only so far that the loops 3^a sunk on the upper edge P^a are not placed under the open latch on the needle stem and are separated from the meshes **4**, **5** by the sinker nose P^n so that they are not pressed. The sinkers P move in the direction Z under the thread *a* into the division and after pressing, when the needles are in the position shown in Figs. 25 and 67, move out of the division and release the loops **3** (Fig. 68). During the next sinking operation the needles N^2 act like the needles N^1 in the preceding sinking operation and work the thread *b* of the guide **2** into ordinary loops **4** and long loops 3^b above the sinker edge P^a on the open latch and below the head of the non-sinking needles N^1, the long loops 3^a having remained on the needles N^2 from the preceding sinking operation and the ordinary mesh **4** being worked into a long needle loop **5**. Pressing takes place as after the preceding sinking operation but with a change in the function of the needle group. This change of function of the group may be effected as in the previously described method. Furthermore, instead of the sinkers shown in Figs. 67 to 70 sinkers of the type shown in Fig. 19 may be used.

The only difference existing between this and the other method is that the long loops sunk by a needle group are not transferred after sinking to the interposed non-sinking needles, but lie in front of the open latch of these needles above the upper edge of the sinker and are therefore already transferred when formed into long loops.

According to these methods and their variations as described goods as shown in Figs. 1 and 2 can be produced which are double-threaded in every needle loop.

Fig. 3 shows a fabric which is only single-threaded in every needle loop, but which otherwise discloses the features shown in Figs. 14 and 15.

In this fabric two superposed courses are formed of two threads *a* and *b*. Each thread is alternately worked into short meshes **4** and long needle loops **5**. In contradistinction to Figs. 1 and 2 and the other fabric shown the long loops **5** are formed into needle loops alone and not to-

gether with the short meshes **4**, so that they form a needle loop by themselves.

The portions 5^a of the long loop **5**, which are within range of the short meshes **4**, form a thread crossing which replaces the sinker loop. For this reason no sinker loop is present in the row of the long needle loops.

The method of producing such fabric is shown in Figs. 36 to 40.

There are two needle groups N^1 and N^2 which are moved by different cams. There are further two thread guides **1** and **2** for the threads *a* and *b*. The manner how the two groups N^1 and N^2 get the thread, the manner of sinking, the hanging over of the longer drawn out loops **3** under the needle hook and the pressing of the old meshes and the non-pressing of the hanging loops **3** are as previously described (up to line **37—37** in Fig. 36). The new feature is that the hung over loop **3** which lies under the needle head on the latch while the short mesh **4** lies below the latch (Fig. 37) is drawn during further descent of the needles through the old mesh **4** which closes the latch (Fig. 38) and the old mesh is thrown off, so that the long loop **3** is made alone into a long needle loop **5** without the short mesh in the goods according to Figs. 1 and 2, since during further motion into sinking position (i. e. motion behind the line **37—37**, Fig. 36) no thread is fed. The needle then goes into pressing position (Figs. 40 and 24) and the loop **5** which hangs on the needles alone is placed below the open latch on the needle shank. Only during the following sinking operation thread is obtained again by both needle groups, which is worked into long loops **3** and short meshes **4**, whereupon the next row is sunk without thread feeding by working out the long loops, etc. By working two threads *a* and *b* the double-threaded course *f—f* (Fig. 3) is formed, which consists of the short meshes **4** and the crosses of the portions 5^a and 5^b, whereupon the course *e—e* is formed by threadless sinking and working out of the long loop **5**.

During the sinking with thread getting (to the right of line **37—37**, Fig. 36) the sinkers move relatively to the needles exactly in the same way as in the method described with reference to Figs. 17 and 18. During sinking without thread getting the sinker remains in the position outside the needle row in which it has to be before sinking with thread getting begins, as indicated in Figs. 37 to 39. Fig. 40 shows the beginning of sinking with thread getting after pressing of the loops 5. The sinker is again in the same needle row.

Fig. 4 shows a fabric in which the sinker weals alternate with a cross weal. Each course and each needle loop is double-threaded (threads *a* and *b*). The long loops **5** form with their shanks 5^a and 5^b toward one side an ordinary sinker loop **6** together with the adjacent short mesh **4** and toward the other side, together with the shank 5^b or 5^a of the adjacent long loop **5**, a crossing.

The method of producing this fabric is as follows:

The two needle groups N^1 and N^2 are independently movable, but each group comprises two needles disposed side by side. The groups operate as previously described with the difference, however, that first two needles of the group N^1 move below the thread guide **1** disposed first in the operating direction R and immediately go up behind this guide, so that the thread *a* is placed behind the head of two needles N^1, whilst two needles of the group N^2 move under and past the other guide **2** and the thread *b* is not brought under their head. Furthermore, the sinker also comprises two differently movable groups P^1 and P^2 (Fig. 43). The sinkers P^1 are located between the adjacent needles of a group N^1 and N^2 (Fig. 41) and do not move like the sinkers P^2 between the needles and under the threads *a* and *b*, but remain outside the needle row in inactive position (Fig. 43). This is attained in known manner by imparting different length to the sinker feet P^d and P^e upon which two cam members act which also differ in length (Fig. 19).

As the thread *a* is sunk by two adjacent needles N^2 into long loops and not caught by two needles N^2, each loop of one of the other thread lies over two needles of both needle groups and extends from the sinker P^2 to the next sinker P^2 (Fig. 41), so that every loop **3** is brought over two needles under the hook in such manner that it is worked only in the next course together with new loops into a needle loop. In this way a crossing is formed between two needles of the group N^1 and two needles of the other group N^2, whilst the thread between two adjacent needles of a group N^1 or N^2 is worked into ordinary sinker loops **6** (Fig. 44), since between these two needles N^1 and N^2 or N^2 and N^2 no sinker stands in the row and thus longer sinking of this thread portion does not occur.

When the loops 3^a and 3^b are worked together with the new loop into a needle loop **4** and **5**, the long loop is drawn through two old meshes and the thread portion between the two needles also worked into an ordinary sinker loop together with the already formed sinker loop, so that all ordinary sinker loops are double-threaded, as shown in Fig. 4.

The operation of the needle groups relative to the thread guides may vary from course to course, as previously indicated, and from one sinking operation to the other one needle group may alternately operate and the other be eliminated.

The new group formation permits also a change in the association of the needles with the various groups, so that for instance the first and second, fifth and sixth, 9th and tenth needle of group N^1 and the third and fourth, seventh and eighth, 11th and 12th needle of the group N^2 work in one row and the next course is formed by the 2nd and 3rd. 6th and 7th, 10th and 11th needle of group N^1 and the 4th and 5th, 8th and 9th, 12th and 1st needle of the group N^2, etc. The operation of the two sinker groups must change accordingly. When in one row the sinkers P^2 are between the needles, P^1 must remain outside in the next row during change of the groups.

Similar to the fabric shown in Fig. 4 is that shown in Fig. 8, in which known plain fabric alternates with loops of the fabric according to the invention, in groups or according to pattern. Instead of plain fabric any other known fabric like 1:1, interlock, etc. may be used.

At the point where the known fabric extends into the new fabric an ordinary sinker loop **6** and a shank 5^a or 5^b will be found.

Fig. 42 shows by way of example how fabric according to Fig. 8 can be produced.

The needles are divided into two groups, according to their motions, a group E comprising in the example shown 3 needles and a group G also comprising 3 needles. Group E operates according to the method shown in Fig. 16, and group G operates normally, i.e. both threads *a*

and *b* are caught by all needles and worked into ordinary double-threaded loops. The sinkers P^1 between the needles of group G remain inoperative during sinking (Fig. 43), so that the threads are not made into long loops on the upper edge P^a. The sinkers P^2 between the needles of group E and the sinker P^3 which lies between every group G and E move according to the invention (Fig. 18) below the range of both thread guides **1** and **2** into the needle row, so that the threads are sunk by the needles of group E into long loops **3** which are brought according to the invention (Figs. 17 and 18) under the needle head and worked into needle loops in the next course. After the sinking operation the sinkers P^1 as well as the sinkers P^2 and P^3 move in the direction Z toward the needles, but do not carry loops (Fig. 44).

Fig. 6 shows a fabric with long loops **10** which are approximately twice as long as the long loops **5**. The longer loops **10** of this course are in the next course but one worked into needle loops together with the long loops **5** of the intermediate course and the ordinary loop **4**. In this way single-, double- and triple-threaded loops **4** or **4**, **5** or **4**, **5**, **10** and crossings of the portions or shanks **5**^{a} and **5**^{b} or **10**^{a} and **10**^{b}, **5**^{a} or **5**^{b} and **10**^{a} or **10**^{b}, etc. are produced.

This fabric has an extraordinarily close Jersey- or crepe-like character.

Figs. 54–57 indicate the method of production. The possibilities of procedure are practically the same as previously described with reference to Figs. 17 and 18 and 46 to 48, with the difference, however, that if a three-threaded needle loop is to be worked the sunk long loop **10**^{x}, which is then made into the long loop **10**, lies after sinking on the sinker edge P^a, as shown in Fig. 54, and is not hung over and placed under the needle hook, as the sinker does not advance any further toward the needles, but retains the sinking position according to the main method (Figs. 18 and 21). During further upward motion of the needles into pressing position the old mesh is pressed off (Fig. 55) and the loop **10**^{x} remains behind the needle back on the sinker edge P^a. During the next sinking operation long loops **5**^{x} (Fig. 56) are sunk near the loop **10** lying on this edge. Since during sinking of the thread to form long loops **5**^{x} no loop **10**^{x} of the preceding sinking operation is positioned under the hooks, the needles form only single-thread loops **4** of regular length. After the sinking operation the sinkers move toward the needles, which is necessary to bring loops over the needle head under the needle hook, so that both loops **10**^{x} and **5**^{x} (Fig. 57) are jointly worked into a three-threaded needle loop **4**, **5**, **10** during the following sinking operation together with the regular mesh **4**.

Fig. 7 shows a fabric, in which the long loop is worked into a needle loop together with the regular loop not in the same weal but in the adjacent weal, so that a thread arrangement resembling warp goods is produced. The shanks of the long loops do not cross each other, but one shank **5**^{a} or **5**^{b} crosses the needle loop and the other shank surrounds the head of the double needle loop which in the same weal precedes the loop through which the long loop is drawn.

The method of producing a fabric as shown in Fig. 7 is indicated in Figs. 52 and 18, 58 and 59. The lateral racking of the loops can be effected before the sinkers move in the direction Z into hanging over position (Fig. 21) or after the sinkers are in this position (Fig. 22).

The mode of operation is the same as described with reference to Fig. 18. The only difference is that the long loops **3**^{a} or **3**^{b} are laterally racked one or two divisions after sinking and before the needles have moved up between the sinkers.

There are different possibilities of racking the loops into range of the adjacent needle.

In circular knitting machines presser wheels **12** (Fig. 64) may be employed which are driven by means of a rack E and a tooth D disposed on the shaft **13** for the presser wheels **12**. The presser wheels **12** possess bevelled teeth. The teeth are bevelled on one side or the other, according to towards which side the sinkers are to be pressed, and the bevelled side acts on the sinkers. The differently bevelled teeth are designated **12**^{a} and **12**^{b}. A presser wheel is provided either with teeth **12**^{a} or **12**^{b} and can be hung over only towards one side. If a loop is to be hung over once in one direction and in the next course in another, a presser wheel **12**, as shown in Fig. 62, possesses teeth **12**^{a} and **12**^{b}. If in a certain course some loops are not to be hung over laterally, the portion of the wheel **12** that ought to act on the sinker has no teeth (Fig. 63).

Figs. 58 and 59 show how the presser wheels **12** are pushed sideways into the adjacent division, when after the sinking operation the sinker has brought the loop **3**^{a} or **3**^{b} lying in its throat P^b in front of the needle head. This lateral pressing must of course occur before the needles move between the sinkers. Fig. 59^a, being a section of Figs. 58 and 59 on the line 59^a–59^a, shows the relative position of the sinkers and needles when lateral pressure begins. The position shown in Fig. 59^a corresponds to a position between those shown in Figs. 21 and 22. The sinkers are laterally pushed away by the teeth **12**^{a} or **12**^{b} of the presser wheels **12** to the extent of a needle division only until the needle has ascended far enough to be between the sinkers and holds back the laterally pressed sinkers from snapping back into normal position. The sinker retains the advanced position (Fig. 24 and line 24—24 in Figs. 58 and 59) in the adjacent division up to the pressing operation. After the pressing operation the sinkers move out of the needle row into inactive position and resume again the normal straight position (Fig. 25, line 25—25 in Figs. 58 and 59). The presser wheels exert pressure upon the sinkers in the foremost position of the latter while they are in a position of rest (Fig. 59^a, line 59^a—59^a in Figs. 58 and 59).

The presser wheel **12** (Fig. 58) which has only the teeth **12**^{b} presses the sinker against the working direction R, so that racking of the long loops in the fabric shown in Fig. 7 is effected to the right. In the next course, in which racking takes place to the left, a presser wheel **12** is used that has only the teeth **12**^{a}. As shown in Figs. 60 and 61, the teeth **12**^{a} are so formed that the sinkers enter the adjacent division in the direction R which is the operating direction.

To permit pressing of the sinkers without causing deformation they must be made of highly elastic steel.

The other possibility of laterally racking the loops is indicated in Figs. 52 and 53 and is restricted to flat machines having a sinker bar plate and one or two needle beds of which one carries sinkers besides the needles, since after working of one course the needle bed or the sinker bed is racked one or two divisions in one direction and in the next course in the other direction. Otherwise, the mode of operating the

needles and sinkers is like the methods shown in Figs. 73, 74, 75 and 76 and described in the introductory portion of the description.

The fabric shown in Fig. 5 discloses a thread position with the fundamental connection according to Fig. 15 in which the long loops 3^a and 3^b are worked into needle loops in one course in the weal on one side and in the following course in the weal on the other side.

The method of producing such goods is indicated in Figs. 52, 52ª, 53, 53ª, 60 and 61. During production, at each sinking operation work is carried on in double division, so that the needle group N^1 forms the thread *a* into loops and long loops and the other needles N^2 are eliminated from the sinking operation. During the following sinking operation the interposed needles of the group N^2 work the second partial course out of the thread *b*, and the needles of group N^1 are cut off from the sinking operation. In the first partial course, Figs. 52 and 52ª, which is worked with the needles N^1, the long loop 3^a is hung over toward one side and in the next partial course which works the thread *b* into loops **3** with the needles N^2 racking is effected toward the other side.

Figs. 52, 52ª, 53 and 53ª show the working method in flat knitting machines in which racking is effected by lateral displacement of the needle or sinker bed.

Fig. 52 shows the sinking of the first partial course from the needles N^1, and Fig. 52ª shows the finished partial course with all needles in the elevated position shown in Fig. 21, the needles N^2 being in catching position, as indicated in Fig. 51. By lateral displacement of the needle or sinker bed the long loops on the sinkers in the position according to Fig. 21, prior to hanging over to one side, are racked to the left as shown in Fig. 52ª. Fig. 53 shows the sinking of the next partial course made of the thread *b* by the needles N^2, and Fig. 53ª shows the sunk partial course with all needles in catching position, and the long loops on the sinkers in the position according to Fig. 21 are racked to the right by lateral displacement of the sinker or needle bed. The long drawn out loops are always hung over before the needles go up out of the position shown in Figs. 52ª and 53ª into pressing position and—seen in working direction—before sinking. The change in the working direction in flat machines, as indicated in Figs. 52 and 53, has no influence upon these processes. The same applies to the cooperation of the sinkers and needles. In the method described with lateral hanging over of both loops 3^a and 3^b both partial courses are worked in one sinking operation and therefore is it possible to work the laterally transferred loop together with the new regular mesh into a needle loop, as both needle groups N^1 and N^2 participate in the following sinking operation.

According to the new method, the groups of the needles N^1 (Fig. 52ª) over which the long drawn out loops are hung have participated in the sinking operation. After the transfer of the loops (Figs. 22 and 23) these needles pass into the pressing position according to Fig. 24. During the next sinking operation the needles N^1 do not operate and the needles of the other group N^2 are working. Since during the following sinking operation the long drawn out loops hanging on the needles N^1 which are not cut off during this sinking operation cannot be worked out, the needles in their disengaged condition shown in Fig. 51 must pass up through the sinking point or position to prevent the old mesh from being thrown off over the needle head and the hung over loop from being under the needle hook.

The loops long drawn out by N^2 are now hung toward the other side. The needles N^1, after the lateral hanging over of the loops, go up into pressing position (Fig. 24) whilst the needles N^1 which now participate in the sinking operation, prior to the sinking step go up only to the extent shown in Fig. 25 so that the loops are not placed below the open latch but remain under the head up to the sinking step and are worked into a needle loop together with the newly sunk regular loops.

This means:

1. The needle which has worked a short mesh **4** and a loop **3** and to which the interposed long loop has been transferred

2. goes into pressing position, presses off the old meshes (Figs. 22, 23 and 24) and the loops remain on the open latch;

3. then this needle goes into the position shown in Fig. 51 and is eliminated from the following sinking operation,

4. whereupon this needle goes up into the position shown in Fig. 25,

5. then again into sinking position, etc.

1. The interposed needles, while the other needles form short meshes **4** and loops **3**, go into the position shown in Fig. 51 and pass through this sinking operation

2. into the position shown in Fig. 25,

3. then into sinking position and

4. after this sinking operation needles and sinkers pass again into the position shown in Figs. 22, 23, 24, so that

5. the same position shown in Fig. 51 is attained again.

In circular frames or circular knitters the method according to Figs. 60 and 61 can be applied also, with the difference that the sinker or needle bar is not racked laterally but the sinkers are pressed into lateral divisions by means of presser wheels **12** having teeth **12ª** and **12ᵇ**.

The fabric can be worked also according to Fig. 14 with lateral racking of the long loops, which changes from course to course. Such a fabric is of pronounced charmeuse type.

In the manufacture of such fabric, as indicated in Figs. 60 and 61, one needle group, which in Figs. 60 and 61 is N^1, forms in two successive sinking operations, also shown in the figures, short meshes **4** and loops **3**, i. e. in one operation from the thread *a* and in the other one from the thread *b*. In this way the needles of the group N^1 form in the two successive sinking operations short meshes **4** and loops 3^a and 3^b. The needles of the group N^2 are eliminated from these two sinking operations and occupy the position shown in Fig. 51. After the sinking operation the needles N^1, which first form short meshes **4** and loops 3^a from the thread *a*, receive again their own loop 3^a owing to the fact that the sinkers in the hanging over position shown in Fig. 59ª are pressed in the working direction R into the adjacent division by a presser wheel **12** with teeth **12ª**. The needles then move into the pressing position shown in Fig. 24 and initiate the next sinking operation in which they participate again to work the thread *b* into meshes **4** and long loops 3^b and the loop 3^a transferred to them into long needle loops **5**. After the sinking of the long loops 3^b, when they are again in hanging over position (Fig. 59ª), the sinkers are pressed by a presser wheel **12** with teeth **12ᵇ** opposite to the working direction

into the adjacent division and the loops 3^b are hung over the needles N^1. After this transfer the needles N^1 pass into the pressing position shown in Fig. 24 and then into the catch position shown in Fig. 51, which the needles N^2 have occupied during the two sinking operations, whilst the needles N^2 ascend only far enough to prevent their loops from passing under the latch, i. e. the needles N^2 do not go into pressing position but into the position which they occupy according to Fig. 50 relative to the old meshes **4**, **5** lying on them and the hung over loops **3**.

In the next two sinking operations the same working cycles are repeated, with the difference that the needles N^2 carry out the motions of the needles N^1 and the latter those of the needles N^2. The working mode of the two needle groups N^1 and N^2 uniformly changes after every two sinking operations.

The goods shown in Fig. 10 resembles the fabric shown in Fig. 5. The only difference is that only one partial course is worked for instance on the needles of only one group N^1 or N^2 like a regular course from one thread and that, changing from course to course, the loops **3** located between the needle loops or the sinker loops are hung over the needles N^1 or N^2 alternately to the left and right and worked in the next courses into needle loops.

Hanging over may also take place toward one side of course.

The manufacture of fabric according to Fig. 10 may be carried out in the manner shown in Figs. 52 and 53, 58 and 59 and 60 and 61, with the difference, however, that only one thread is worked during sinking and only one needle group, whilst the other needle group is constantly eliminated from the sinking operation by passing without any variation in its vertical position through all systems and therefore forming no loops.

Lateral transfer of the loops is effected as described for all preceding methods, so that always the needle which sinks the thread (for instance N^1 in Fig. 52) receives the loop **3** positioned above this needle (Fig. 52ª).

Fig. 9 shows another variation in hanging over in a fabric worked with two partial courses in one row and with two threads.

In this example all loops of one partial course, which may show the fundamental connection according to Figs. 14 or 15, are worked in the following loop of the same weal into meshes **5** and loops 5^a, whilst the loops of the other partial course, changing from course to course, once to the right and once to the left, are worked in the following course of the adjacent weal located on the right or left into the needle loop **4** or **5** with the shanks 5^b.

It follows that always a three-threaded weal with the loops **5**, **5** and **4** alternates with a single-thread weal formed of meshes **4**. It is possible of course to provide for the change from a three-threaded to a single-threaded loop not only in the courses but also in the weals.

In the manufacture of a fabric as shown in Fig. 9 one may proceed by working each partial course in a separate sinking operation (Figs. 45, 47, 52, 75 and 76).

A partial course is for instance worked out of the thread b by the needles N^2, and its loops $3b$ are hung over the needles N^2, and the latter pass in the elevated position shown in Fig. 51 through the sinking point where the needles N^1 operate and work the thread a into meshes **4** and loops 3^a above the needles N^2, as indicated by the first sinking operation (seen in the working direction R) in Fig. 52. These loops 3^a are formed without lateral racking, i. e. hung again over the needles N^2 over which they are formed. The needles N^2 carry therefore the loops 3^b of the one partial course and the loops 3^a of the other partial course. During the following sinking operation when the needles N^2 are working the loops hanging on them together with the newly sunk meshes **4** are worked into long double loops **5**,**5**. The loops 3^b formed during sinking from the thread b are hung again over the needles N^2, etc.

The needle groups operate therefore from one sinking operation to the next in the following order:

Group N^2: Loops are hung over the needles N^2 by lateral racking;
Group N^1: Loops are hung over the needles N^2 without lateral racking;
Group N^2: Loops are hung over the needles N^2 by lateral racking;
Group N^1: Loops are hung over the needles N^2 without lateral racking, and so forth.

The long loops 3^a and 3^b are thus always worked in the weal of the needles of a group into double long loops **5**, **5** together with the mesh **4**.

If the needle groups are for instance to operate in the order N^1 N^1, N^2 N^2, N^1, etc., the needles which are to form the double loops **5**, **5**, that is, the needles N^2 (Fig. 32) in this instance, pass into the position shown in Fig. 51 not only after the transfer of the laterally racked loops 3^b during the sinking operation of the needles N^1 but also after the transfer of the loops 3^a formed by the needles N^1 during the following sinking of the needles N^1. During the next sinking of the needles N^1 the needles N^2 also pass into the position according to Fig. 51, but, as shown in Fig. 51ª, both loops $3a$ and 3^b are now under the head of the needles N^2 and the old meshes **4** and **5**, **5** lie on the closed latch. In the next two sinking operations the needles N^1 operate as described with reference to needles N^2 and move into the position shown in Figs. 51 and 51ª so that meshes **4**, long loops **5**, **5** and loops 3^a and 3^b are formed by them.

The fabrics according to the invention, in which, as shown for instance in Figs. 5, 7, 9 and 10, all or some long loops **3** are worked in a laterally disposed weal together with the newly formed regular meshes **4** into a long needle loop **5**, may be worked also in the manner shown in Figs. 36 to 40 according to which the laterally transferred loops **3** alone are made into a long needle loop **5** in the following courses. The motion of the needles must, however, always be such that the needle which is to form single-thread loops only goes into sinking position without any thread feed, so that the loop **3** arranged thereon during the preceding sinking operation is alone worked out to form the long loop **5**. This method can be applied when both partial courses are formed in one and the same sinking operation or in two successive ones.

Fig. 77 shows for instance the application of this method to a flat knitting machine, though it can be carried out also by circular knitters if presser wheels **12** of the type shown in Figs. 58, 59, 60 and 61 are available.

The application of the method indicated above as shown in Fig. 77 makes it possible to produce a fabric with laterally hung over loops **3**, which alone are worked into long needle loops **5** in the

following course, in the manner of the fabric shown in Fig. 5. The operation is as follows:

The operation to be described precedes the sinking operation shown in Fig. 77 when the thread *a* is formed by the needles N^1 into meshes **4** and loops 3^a and by lateral racking during the upward motion according to Fig. 23 is hung again over on the needles N^1. The needles N^1 on which the long loops **3** are hung again pass up as high as pressing position (Fig. 24), so that only the meshes **4** are brought below the latch on the needle shank. During this motion of the needles N^1 in this sinking operation which precedes the sinking operation shown in Fig. 77 the needles N^2 have worked the long loops into long needle loops **5** and have then passed out of the position shown in Fig. 49 up into pressing position (Fig. 40) without any hanging over of loops, so that the loop **5** arranged on the needles N^2 is placed under the latch. In the operation shown in Fig. 77 the needle group N^2 sinks the thread *b* into loops 3^b and regular meshes **4** and knocks over the long loop **5**. In the meantime, the needles of the other group N^1 move down in the direction R before the thread guide **2** and into the position shown in Fig. 37 and then farther down into the position according to Fig. 38 and into sinking position without having received any thread and during this motion work the long loops $3a$ which they carry alone into long loops **5**. After this sinking operation the loops 3^b formed on the needles N^2 are brought again upon the needles N^2 by lateral racking and hanging over according to Fig. 23 when the needle groups N^1 and N^2 jointly move out of the position shown in Fig. 49 into pressing position (Figs. 24, 40). The needles N^1 have therefore no loops, since by lateral racking the long loops are always hung again over the needle on which they were sunk. During the sinking operation following the one shown in Fig. 77 the needles N^2 work again long loops 3^b alone into a loop **5** as in the operation preceding the sinking operation shown, and the needles N^1 sink again meshes **4** and loops 3^a, whereupon the process shown and described is repeated.

In the example shown in Fig. 77 both needle groups participate in a loop forming operation during a sinking operation, although during a sinking operation a partial course is formed from a single thread only by one needle group. If a needle is to work two long loops alone without the regular mesh into long needle loops **5**, **5**, as indicated in Fig. 9, though with the difference that the long loops are staggered in the weal, the needles N^1 or N^2 pass like the needles N^1 in Fig. 77 into a position shown in Fig. 23. These needles with their hung over loops **3** then move into the position shown in Fig. 24, then again into the position shown in Fig. 37 and Fig. 38, whereupon not the sinking position is occupied as in the preceding examples, but the needle passes on the level of the position shown in Fig. 51 through the working system, and the loops 3^b sunk by the needles N^2 are not laterally racked but are hung over the needles N^1. These needles then do not pass into pressing position like the needles N^2, but move only as high as shown in Fig. 50. During the following sinking operation the needles N^1 pass before the thread guide in the operating direction R into sinking position, so that both loops 3^a and 3^b alone, without having received thread and without forming a mesh of ordinary length, are worked into two long needle loops **5**, **5** on one needle, namely needle N^1. During this operation of the needles N^1 the needles N^2 form the thread into regular meshes **4** and long loops **3**, whereupon the long loop formed by the needles N^2 is hung again over the needle N^2 by lateral racking, and both needle groups N^1 and N^2 go into pressing position as shown in Figs. 24 and 40. Then the working mode of the needles is repeated, that is, needles N^2 carry out the motions of the needles N^1 as just described and needles N^1 those of needles N^2.

Fig. 11 shows an example of plated fabric which is like the fabric shown in Fig. 1 plated in a novel manner.

To plate in the known manner all fabrics according to the invention would require four-threaded loops. An example is shown in Figs. 45 and 47.

To plate the loops double-threaded, that is, to arrange the two threads present in the fabric according to the invention in plating manner if they are different or differ in color, care must be taken that the hung over long loop is not alternately placed on the front side, as indicated in Fig. 11. It follows from the examples shown and described that the hung over long loops **3** as long needle loops **5** always lie on the outside of the face side and the short meshes **4** always on the outside of the back. Each needle loop in the weal **2** and the course **3** (Fig. 11) comprises a long white loop **5** and a black loop **4** of ordinary length. The white loop **5** lies in the next loop on the outside of the front side (weal **1**, course **3**). The short mesh **4** lies outside on the face side and the long loop **5** formed of the loop **3** is laid so that it lies outside on the back. According to the invention, this is done for instance in the manner shown in Figs. 65 and 66 by pressing back the needle N^1 on which the long loop **3** hangs which is worked into the long loop lying on the back at the moment when the newly sunk loop **2** meets the hung over loop **3** in the needle head. By the depression of the needle N^1 the hung over loop **3** is then caused to alter its position in the needle head in such manner that as loop **5** it is placed before the newly sunk loop **2** which then becomes mesh **4** outside on the back, whilst on the needles N^2, which are not pressed back, the loops **3** lie behind the newly sunk loops **2** in the needle head, so that the loop **3** formed into a mesh is placed outside on the face side and the mesh **4** formed of the loop **2** outside on the back.

The fabric according to the invention may be worked also with plush loop lining, as shown in Fig. 78. In this fabric in which the plush loops are worked in in the manner of loop-plush fabric the arrangement according to Fig. 1 is chosen as basis. The plush loop F is tied up between the long loops **5** and the regular short meshes **4** are tied into needle loops **7** and long sinker loops **8**.

Figs. 79 and 80 show a manner of producing goods according to Fig. 78. The mode of operation of the sinkers and needles for working the ground fabric is the same as that shown in Figs. 17 and 18 and described above, with the difference that another thread F is fed to both needle groups N^1 and N^2. The guide **11** for the thread F, in order to obviate the necessity of varying the needle motions, is arranged so much lower relative to the needles than the two other thread guides **1** and **2** are with respect to the threads *a* and *b*, so that the thread F is always brought under the hook of the needles of both groups. Whilst during sinking the thread *a* is worked into needle loops **4** and long loops 3^a by the needles N^2 and the thread *b* into needle loops **4** and long loops 3^b by the needles N^1, the thread **F** is

worked by all needles N^1 and N^2 (Figs. 79 and 80) as second thread over the edge P^a of the sinker P into long sinker loops 8 and needle loops 7. Since the thread F is formed on one sinker only into a plush loop 8 and not worked like the loops 3^a or 3^b on two adjacent sinkers P over and beyond a needle division, the plush loops are not brought upon the needles during the motion of the sinkers for hanging the loops 3^a or 3^b over the needles (Fig. 80), but remain only on the sinkers P until they move in the direction V out of the needle row and are thrown off (Figs. 79 and 80). The plush thread F, which owing to the position of the thread guide occupies the position taken by the ground thread during plating and thus lies before the threads *a* and *b* on the face side, is covered by the hung over loops 3^a and 3^b or the long loops 5 formed therefrom which are always on the face side of the goods, so that the needle loop 7 is placed between the meshes 4 and the needle loops 5 (Fig. 78).

Fig. 12 shows an example of weft fabric with a ground fabric according to Fig. 2, in which, as indicated for instance in Fig. 15, every other course consists of a partial course M—M and the interposed courses are worked out of the other partial course N—N. In this weft fabric each partial course M—M is provided with a weft thread S in such manner that it lies in the partial courses M—M between the needle loops 4, 5 and the shanks 5^a of the long loops 5 which extend from the mesh 4 of the preceding partial course to the meshes of the next partial course. In the other partial course *a—a* the weft thread S is placed between the needle loops 4, 5 and the shanks 5^b of the long loops 5.

This kind of weft fabric is quite close, as each total course comprises two partial courses M—M and N—N, so that two weft threads lie over each mesh, each of which is separately tied and lies closely to the next one.

Figs. 75, 76, 73 and 74 show a method for producing goods shown in Fig. 12. According to this method only one needle in a system works a thread *a* into meshes and long loops 3^a, and the other needles N^2 are eliminated by passing through the system in the low position shown in Fig. 73. Where the needles have reached this low position, a weft thread guide 10 is disposed between the lower sinker edge P^c and the upper edge K of the needle bed, which lays the weft thread S (Fig. 73) so as to be placed behind the needles which, after the thread passes to the next system, go up again, which in this instance are the needles N^2. In the next course, the weft thread is placed again behind the needles N^1, so that by this change of operation of the needle groups N^1 and N^2 and owing to the positioning of the weft once behind the needles N^1 and then again behind the needles N^2 the weft thread S will have the position shown in Fig. 12, since it is placed between the loops 5^a or 5^b of the loops 3 and the meshes 4 hanging on the needles (Fig. 74) after it has been inserted behind the ascending loops and the long loops 3 have subsequently been hung over these needles.

The weft fabric according to Fig. 13 comprising two partial courses in a course corresponds to the fabric shown in Fig. 1 and has only one weft thread S for each course, which lies between all loops 5^a or 5^b of the long loops 5 and the needle loops 4, 5 of the course concerned.

To produce such fabric both partial courses are simultaneously worked, as indicated in Figs. 71 and 74. The same method is shown in Figs. 17 and 18, though without working in weft threads. Both needle groups N^1 and N^2 sink the thread *a* and *b* and on having reached their lowest position, the weft thread is inserted as described above. It follows, as shown in Fig. 13, that the two partial courses worked into one course have only one weft thread which lies between all loops 5^a, 5^b of the long loops and all meshes 4, 5. All loops 3^a and 3^b of both partial courses, after the weft thread has been laid (Fig. 73), are hung after and during the rising of the needles N^1 and N^2 over all needles, so that the weft thread lies behind all needles between the loops 3^a and 3^b and the needle meshes 4, 5 (Figs. 71, 72 and 74).

The method just described with respect to the motion of the weft thread can be applied also to all other fabrics according to the invention, which use weft threads.

The methods described and shown can be carried out and the fabrics produced by knitting machines having two rows of needles. A fabric can be made for instance which partly consists of the fabric according to the invention and partly of known goods of the type hitherto made on knitting machines having two rows of needles, such known goods being for instance 1:1 and interlock.

According to the invention, it is further an object thereof to provide for selectively using known knitting machines either for making goods according to the invention or known types of fabric of the class that can be produced thereon.

The method of producing fabric according to the invention is the same as previously described, and the mode of operation of the two rows of needles during production of known goods remains as usual.

For carrying out the method according to the invention on knitting machines having two rows of needles one of the two needle beds is fitted with hang-over sinkers in addition to the needles. These sinkers correspond in configuration and operation to the sinkers P shown in Figs. 19 to 26. To prevent the annular projection T on the cam of such machines, which holds the ribbing needles in their guide, from interfering with the motion of the sinkers, the latter are provided on their upper edge P^k facing the annular projection T with a recess P^u which is equal in length to the path of the sinker from inoperative into operative position plus the width of the projection T.

Where goods according to the invention are to be made, the needle or needles of the row in which the hang-over sinkers are arranged are cut off from their loop forming work and for each eliminated needle two sinkers on either side of the needle are actuated (Figs. 19 to 26). This can be seen also in Fig. 82 which shows the needles N of the needle row in which the sinkers P are disposed in inoperative position, i. e., the sinkers P are in hanging over position according to the sinkers in Fig. 22. The needles of the other row, which are divided into two groups N^1 and N^2, operate in accordance with the kind of fabric to be made in the same manner as in machines having only one row of needles.

If known goods that can be produced on a machine with two needle rows, such as 1:1, interlock, etc. are to be made, the two sinkers P disposed on either side of a needle in the row N are held inoperative, as indicated in Fig. 81. The needles N, N^1 and N^2 of both needle rows operate at these points as usual.

If regular meshes and meshes according to the

invention are to be worked in a course, as indicated in Fig. 84, the needles of the rows N^1 and N^2 work regular meshes on N^2, whilst on every other interposed needle N^1 the long loop sunk by the two superposed sinkers P is hung over and worked into a loop. The other needles N^1 are eliminated like the needles of the row N^2 with the exception of those needles which are positioned above the eliminated needles N^1 of the rows N^1 and N^2.

To permit sinking of long loops **3** to be worked out into long needle loops **5**, the sinking edge P^a of the sinker P (Fig. 84) lies on a higher level than the needles N, over which the thread is sunk when regular fabric is worked.

Some of the sinkers P may be pushed into the adjacent division by means of presser wheels **12** (Fig. 63) in order to effect lateral racking of the longer drawn out loops towards one or the other side for all or some loops. Where the needles N operate no teeth **12**^{a} or **12**^{b} are provided in the wheel **12**.

If on such knitting machines having two rows of needles and being equipped according to the invention only ordinary known fabric is to be made, it will only be necessary to disengage the sinkers P, as indicated in Fig. 81. If only goods according to the invention are worked, all needles of the row N are disengaged, as shown in Fig. 82.

It is further possible to work on such machines having two rows of needles fabric according to the invention together with ordinary plain fabric. For this purpose the sinkers P are provided in known manner with two pattern feet P^d and P^e. The sinkers with the foot P^d are for instance brought into proper position for producing goods according to the invention, whilst the sinkers with the foot P^e operate as in plain goods.

The arrangement of the sinkers between the needles of one row can be made in various ways. According to Fig. 83, the needles of the row N register with the gap in the other row N^1 and N^2 and the sinkers are milled at the side of the needles, so that each sinker abuts against one side of the needle stay.

Fig. 84 shows a circular knitting machine, in which the needles of one row are arranged on the needles of the other row. In such machines the sinkers are disposed in slots cut into the center of each needle stay.

At the same relative arrangement of the two needle rows the sinker slots, according to Fig. 85, may be cut into a stayless needle bed in such manner that the sinkers inserted in the slots and moving therein take over all the function of the needle stay. This arrangement is particularly advantageous in fine gauge machines.

In the examples shown, the method described is applied to machines having latch needles, the latch serving for separating the old mesh on the needle from the newly hung over loop both when the latch is opened and closed (Fig. 26).

If the methods are to be applied to machines provided with spring needles, the function taken over by the latch in latch needle machines must be carried out by other means.

For example, Figs. 86 to 90 show that in such case sinkers P^z of known type can be used which move toward the needle back and thus towards the other sinkers P^v. Separation of the long loop **3** from the loops **4**, **5**, which in latch needle machines is effected by the latch, is brought about in machines according to Figs. 86 to 90 by the nose P^n of the sinkers P^v.

The method is carried out as follows:

The sinkers P^z operate in the same manner as the sinkers described before, and it is therefore only necessary to described the position of the other sinkers P^v. Fig. 86 shows the sinking of the loops **4** and of the long loops **3** on the edge P^a of the sinkers P^z, whilst the sinkers P^v are in inoperative position and about to move in the direction V toward the needle breast into operating position. Fig. 87 shows this sinker P^v in operating position, i. e. knocking over position, and the sinkers P^z have moved in the direction Z towards the needle breast into hanging over position, so that the needle when going up can pass through the long loops. Fig. 88 show the position of the long loop hung over on the needle and separated from the meshes **4**, **5** on the needle by the nose P^n of the sinkers P^v. The latter have receded somewhat from their knocking-over position, but only to such an extent that their nose is still in the needle row and separates the meshes **4**, **5** from the long loops **3**. In the meantime, the sinkers P^z are inactive, whilst the needles get new thread *a* and *b*, or *a* or *b*. Fig. 89 shows the pressing position in which the sinkers P^v with their nose P^n are still in the separating position shown in Fig. 83. The needles have moved down into pressing position and are pressed off by a press member W or other suitable means when the point of the needle hook is above the meshes **4**, **5** on the needle shank and the long loop **3** lies under the hook. During farther descent of the needles into sinking position the meshes **4**, **5** are pressed off over the needle and the long loop **3** under the hook is worked out with the thread *a* or *b* into a loop or sunk over the edge P^b of the sinkers P^z to form new long loops. During this sinking operation the sinkers P^v move out of the needle row in the direction Z, so that the loops **3** are released by the separating point P^n when the meshes **4**, **5** are disposed on the closed hook of the needles and the sinkers and needles occupy again the relative position according to Fig. 86. If ordinary plain fabric is worked, the sinkers P^z are withdrawn in the direction V (Fig. 90) that they are eliminated from the loop forming process, whilst the sinkers P^v carry out the regular motions.

If the method shown in Figs. 67 to 69 is to be applied to machines having spring needles, sinkers moving toward the needle back are not used but only sinkers that move toward the needle breast. The long loops are kept separate from the meshes **4**, **5** on the upper edge of the nose P^n, as shown in Fig. 95, and are pressed off, as indicated in Fig. 89.

Separation of the meshes **4**, **5** from the long loops **3** by means of the nose P^n of the sinkers P^v can be effected also in machines having latch needles if two sets of sinkers P^v and P^z are provided. The function of separating is thus carried out jointly by the latch and the nose P^n. The working position of the sinkers and needles relative to one another according to Figs. 91 to 94, which indicate the range of uses of two sets of sinkers in case of latch needles, is the same as in Figs. 86 to 89. The relative position of the latch needles to the sinkers P^z (Figs. 91 to 94) is also the same as previously described.

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25 Sheets-Sheet 1

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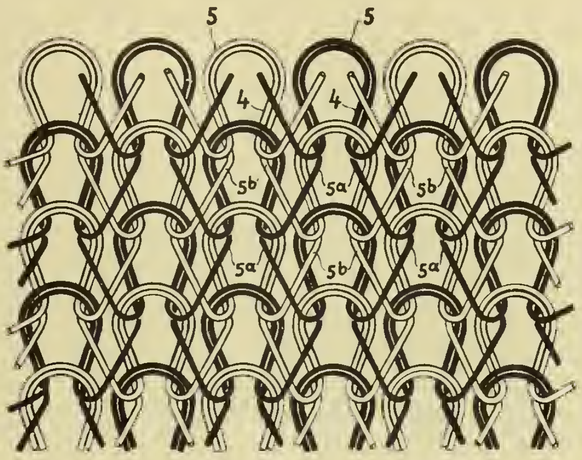

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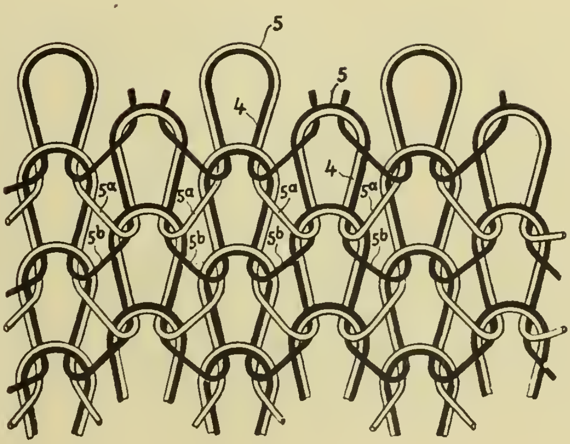

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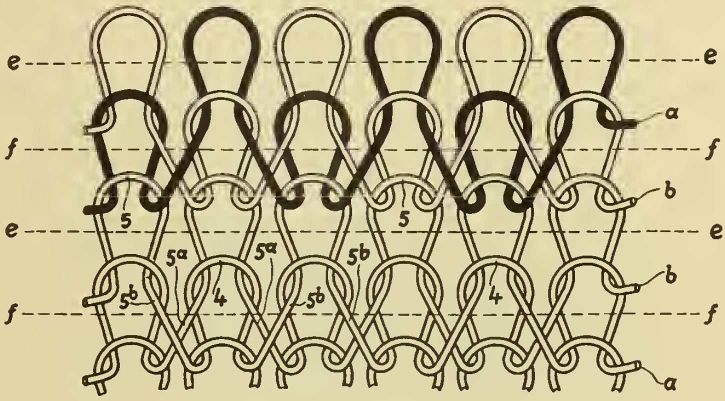

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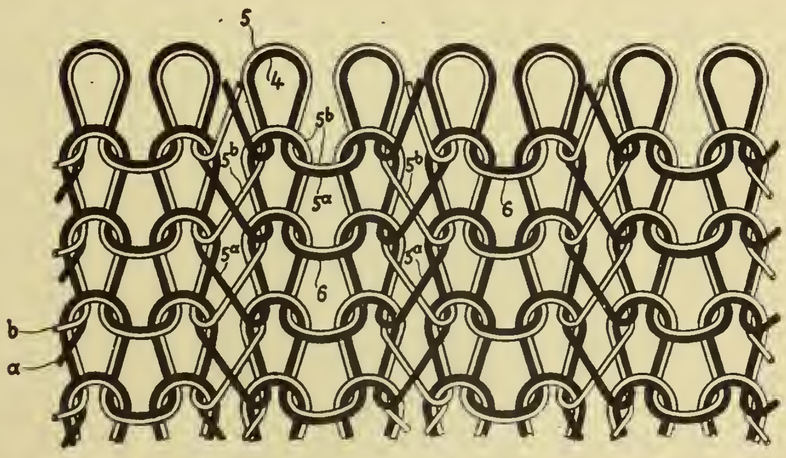

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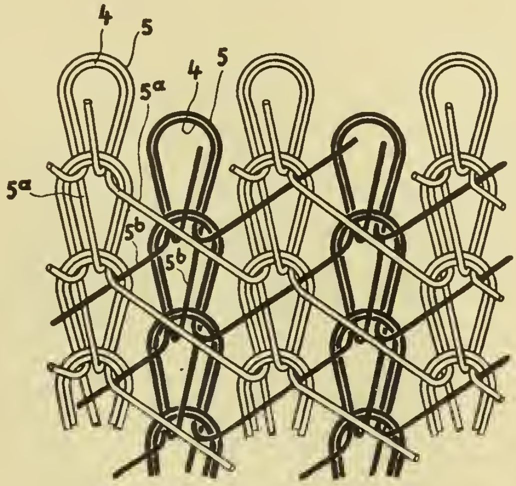

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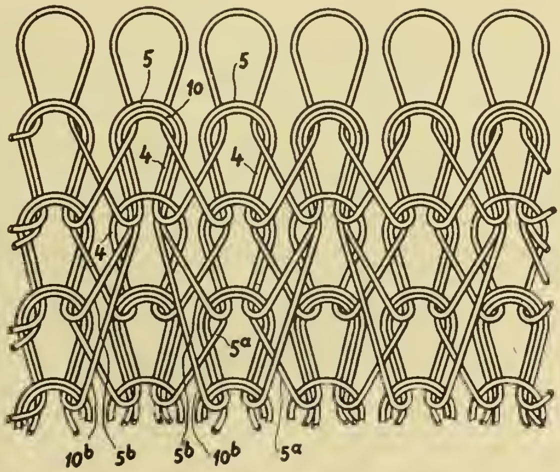

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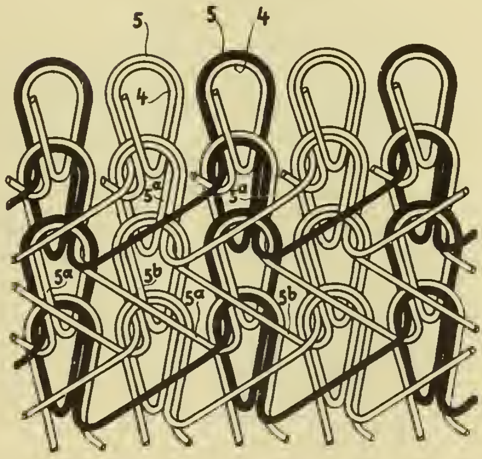

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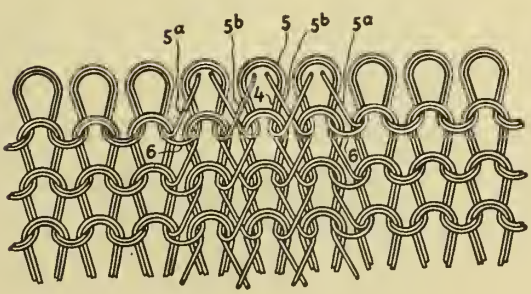

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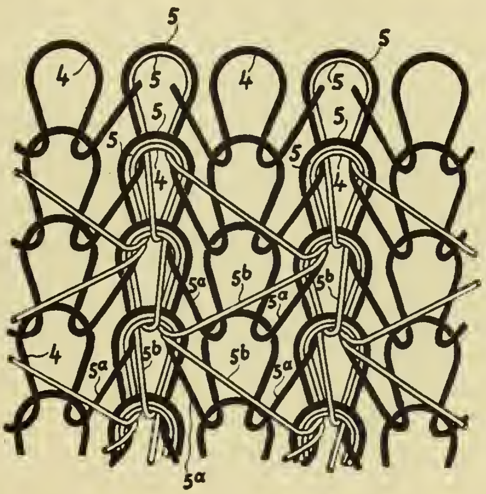

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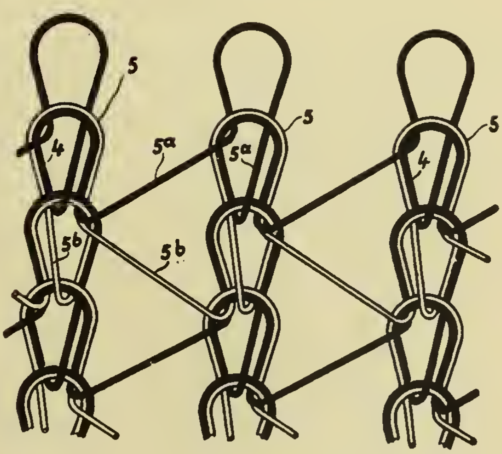

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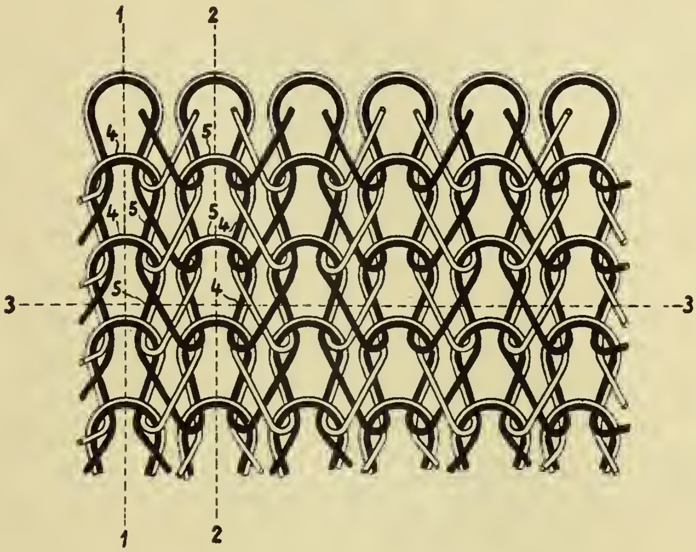

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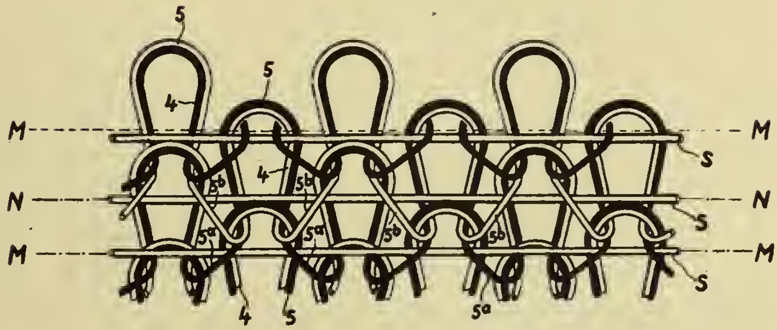

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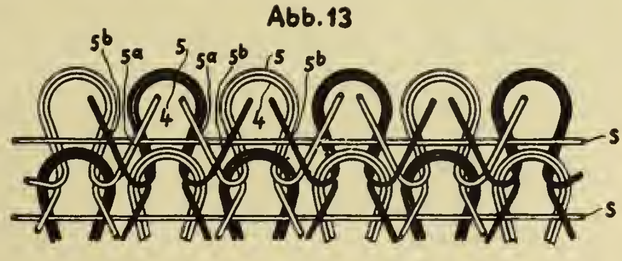

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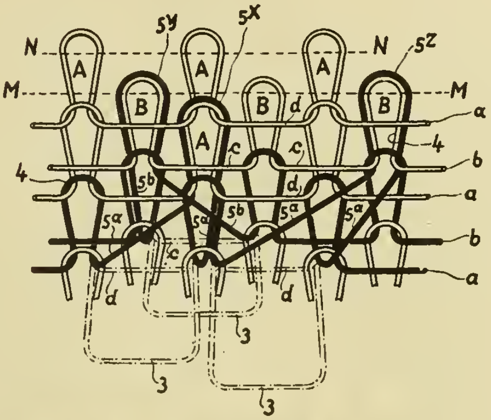

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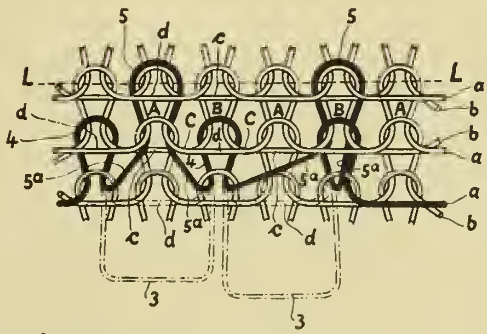

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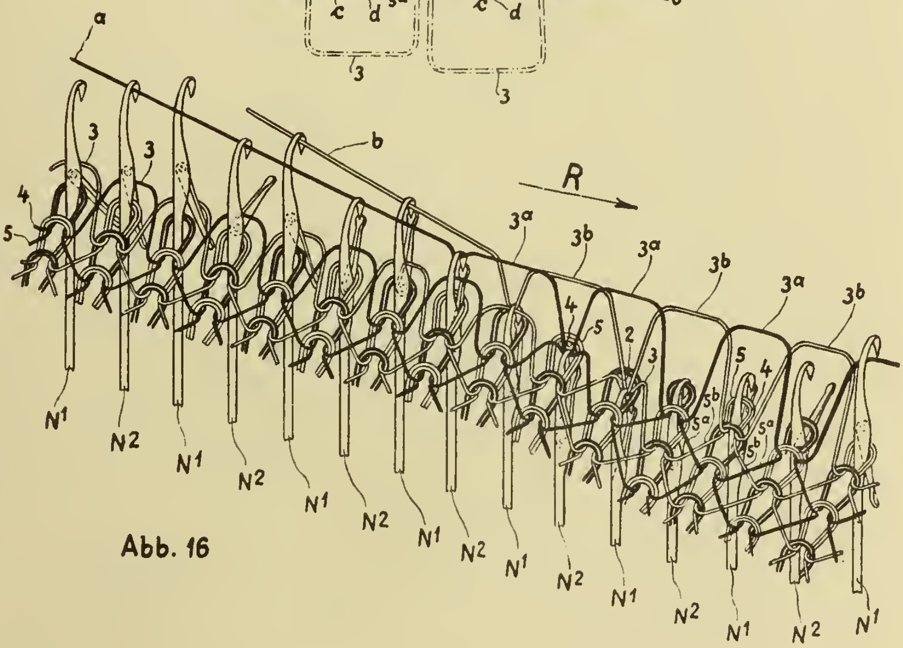

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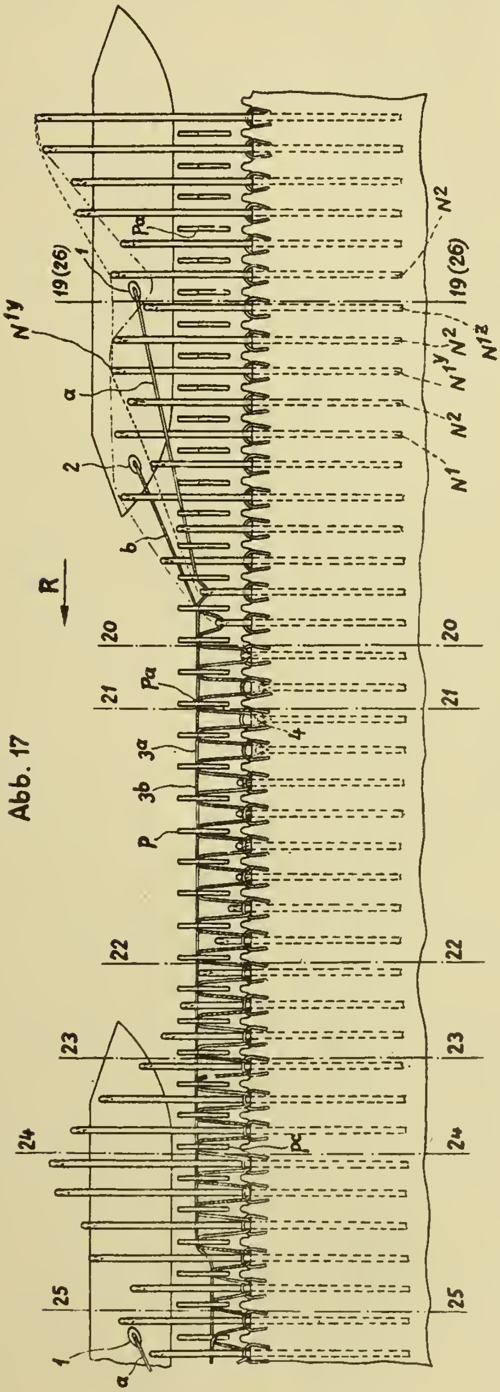

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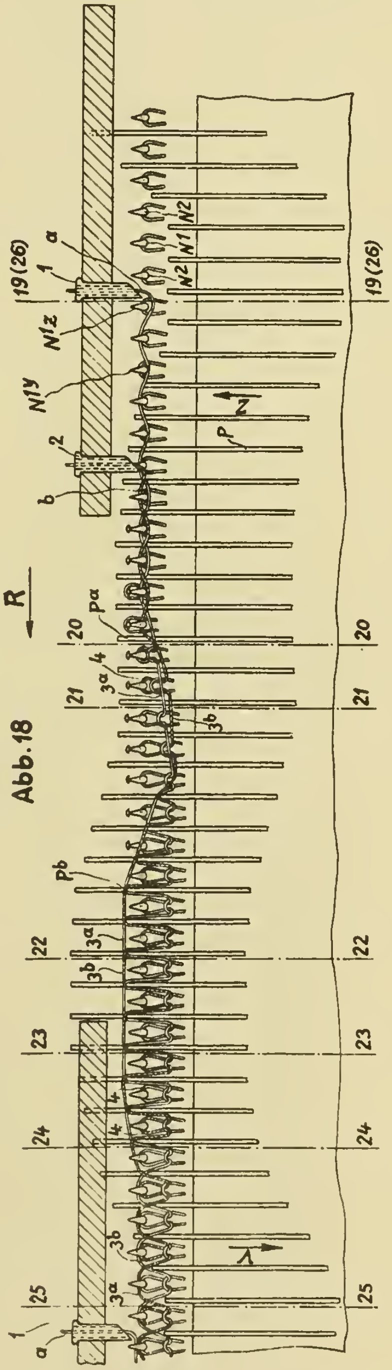

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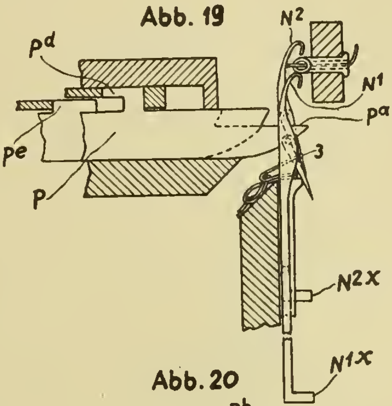

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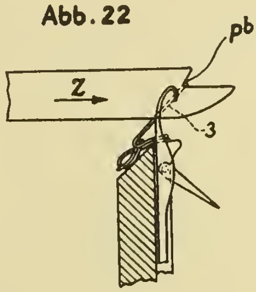

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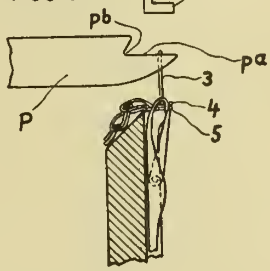

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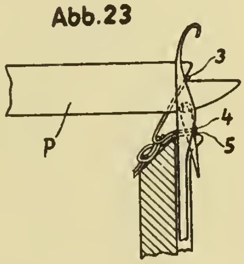

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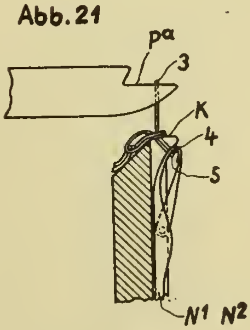

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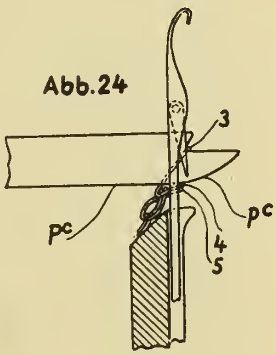

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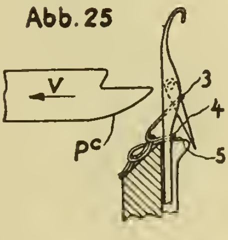

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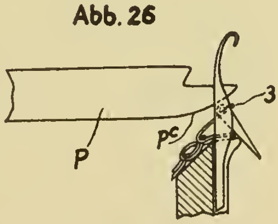

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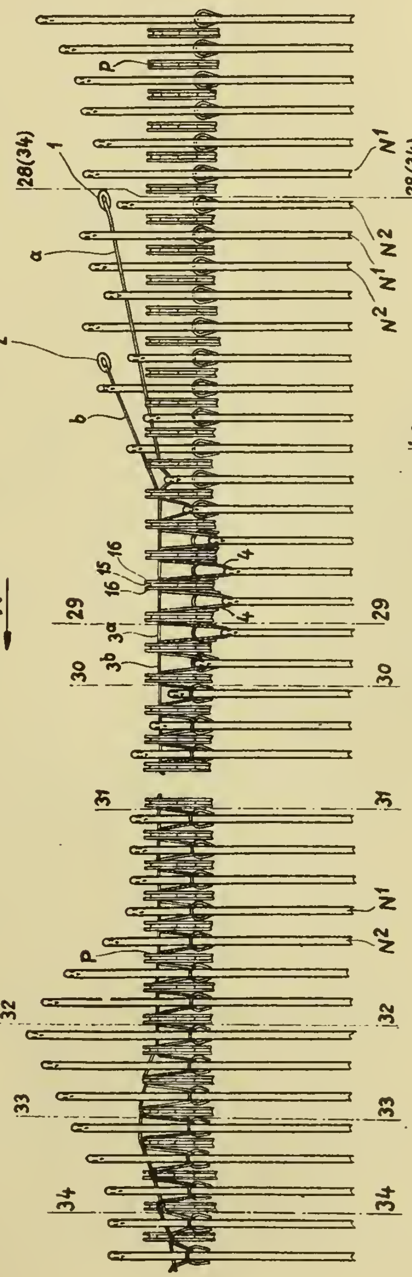

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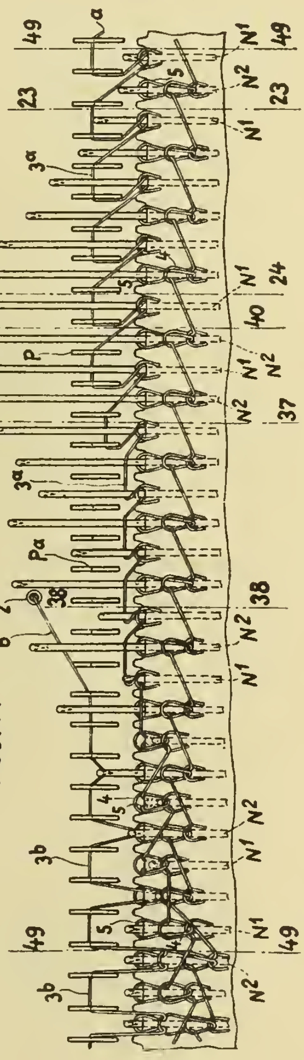

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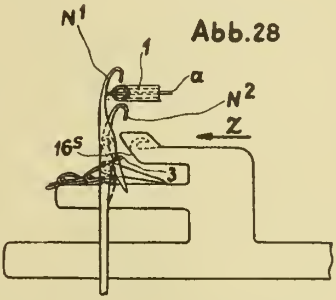

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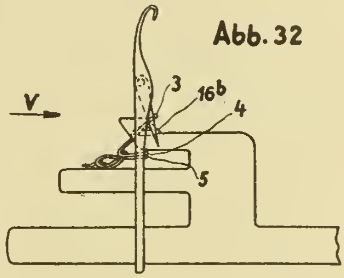

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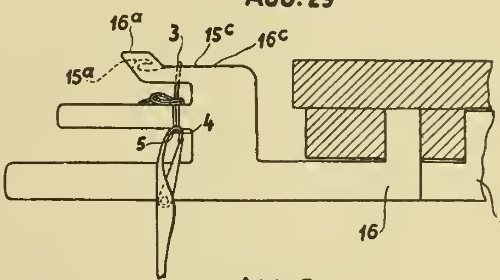

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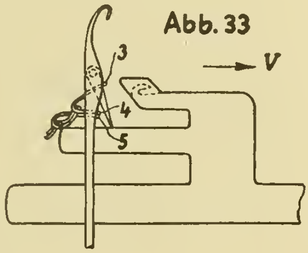

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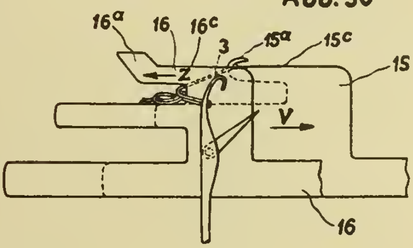

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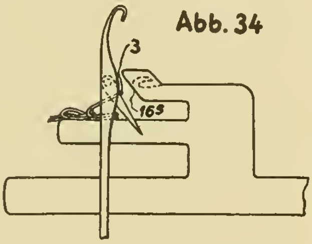

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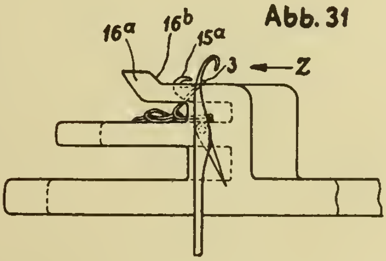

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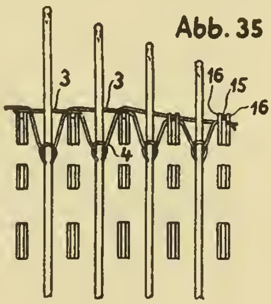

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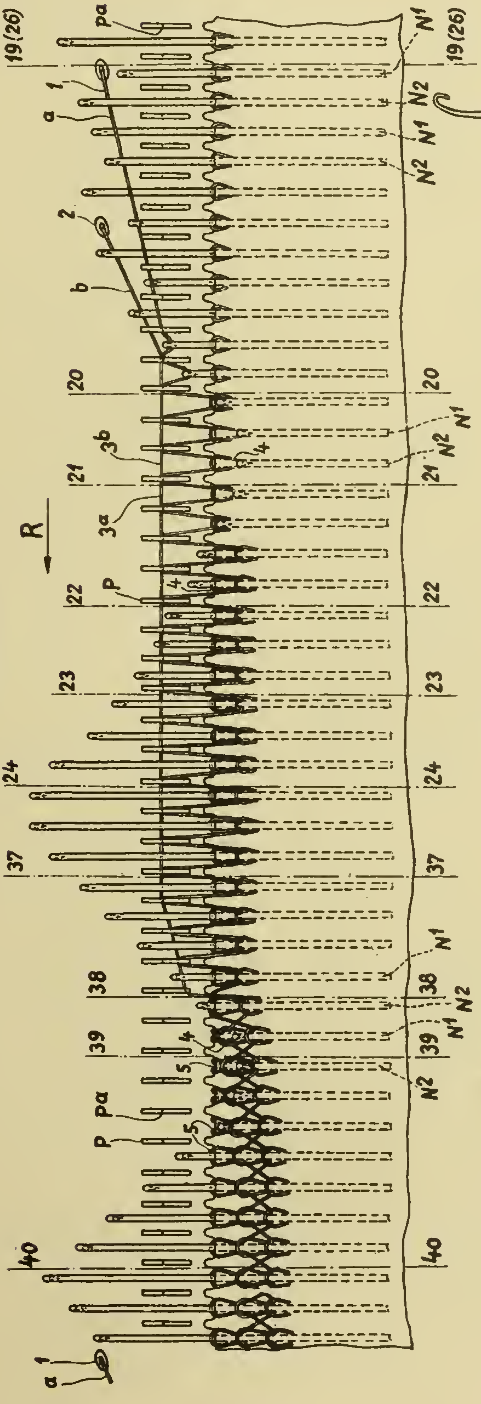

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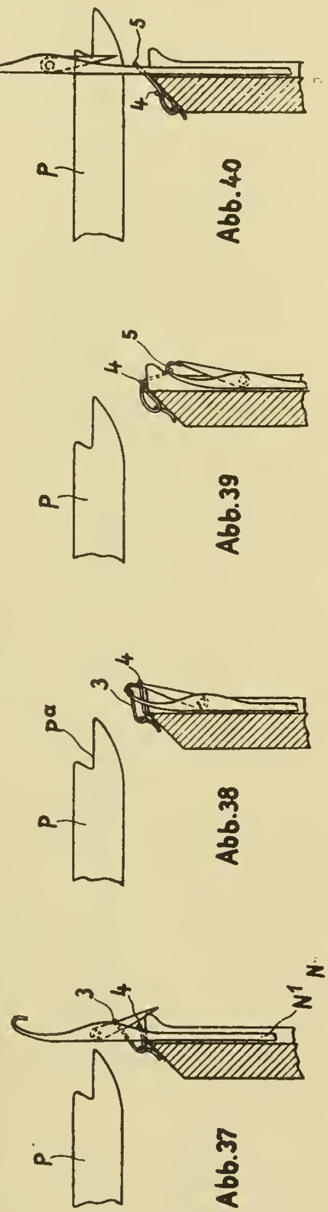

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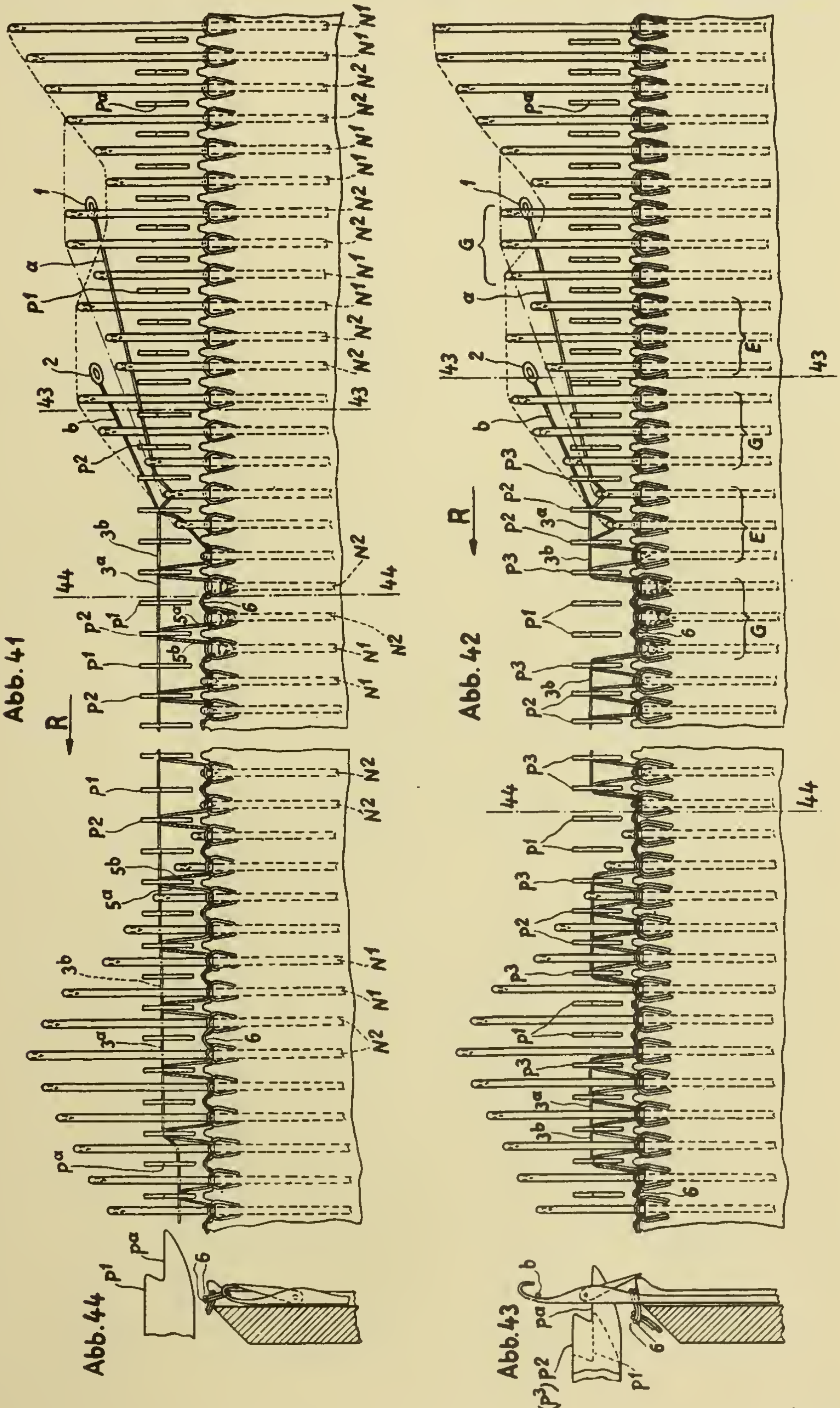

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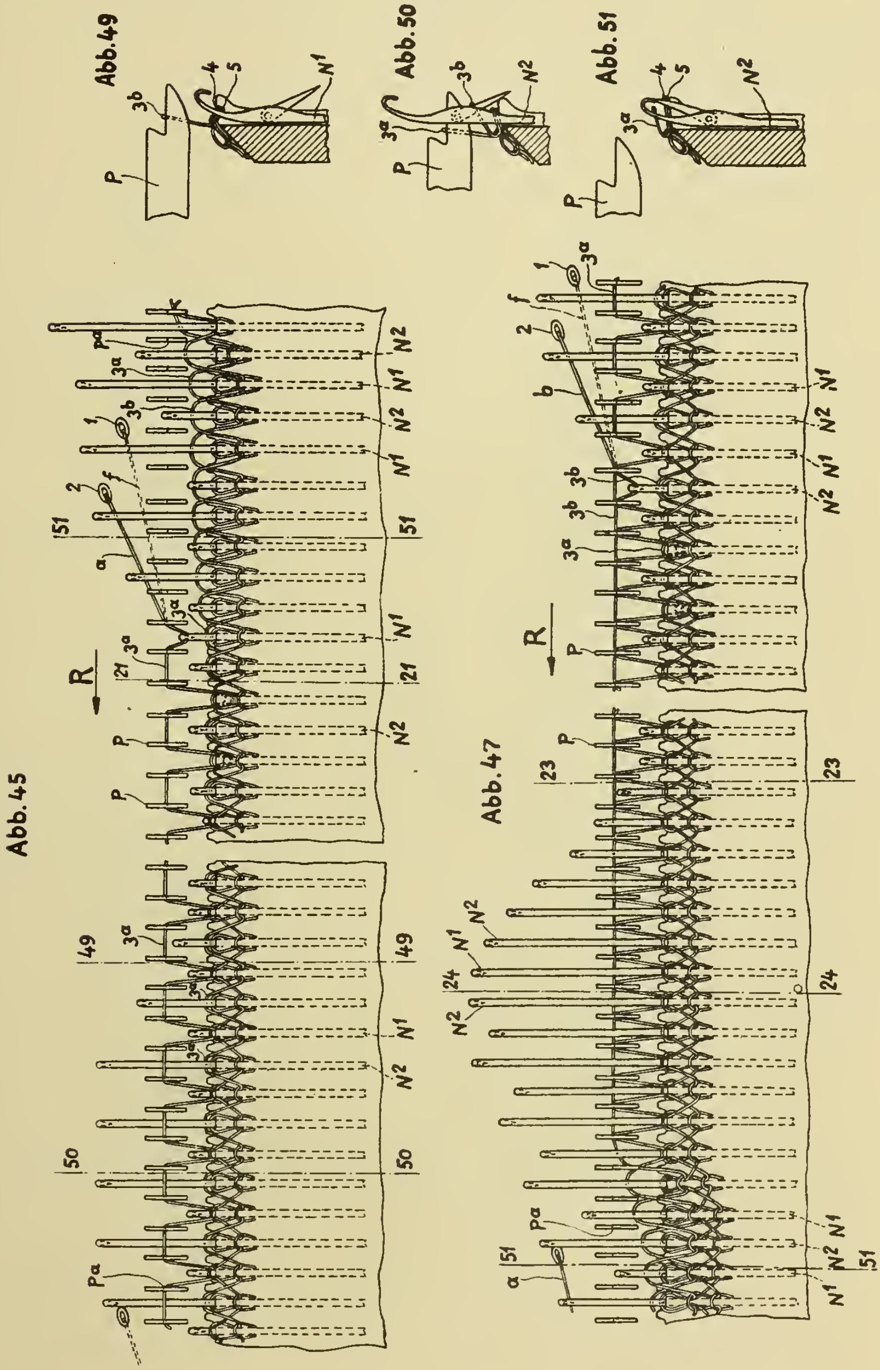

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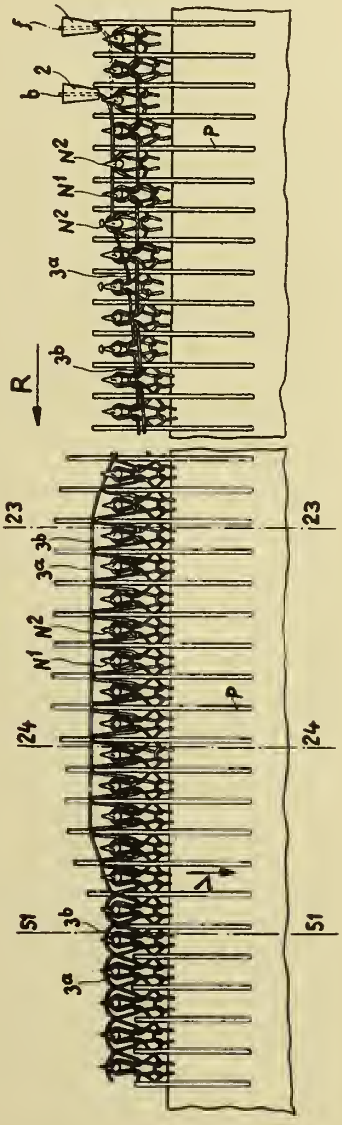

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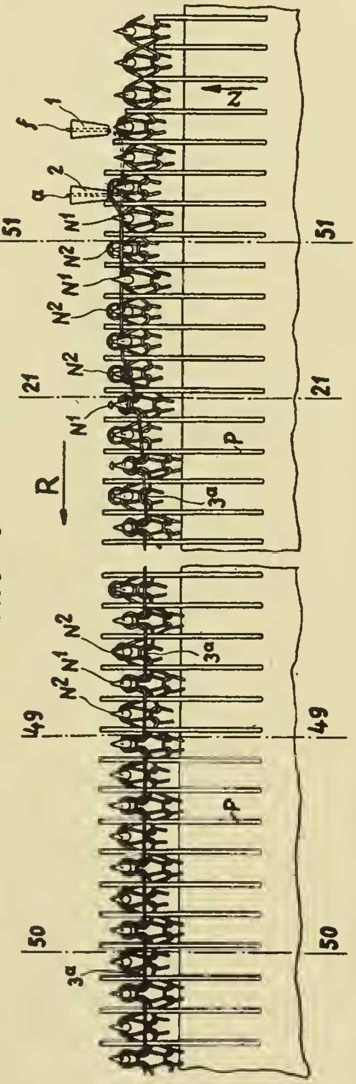

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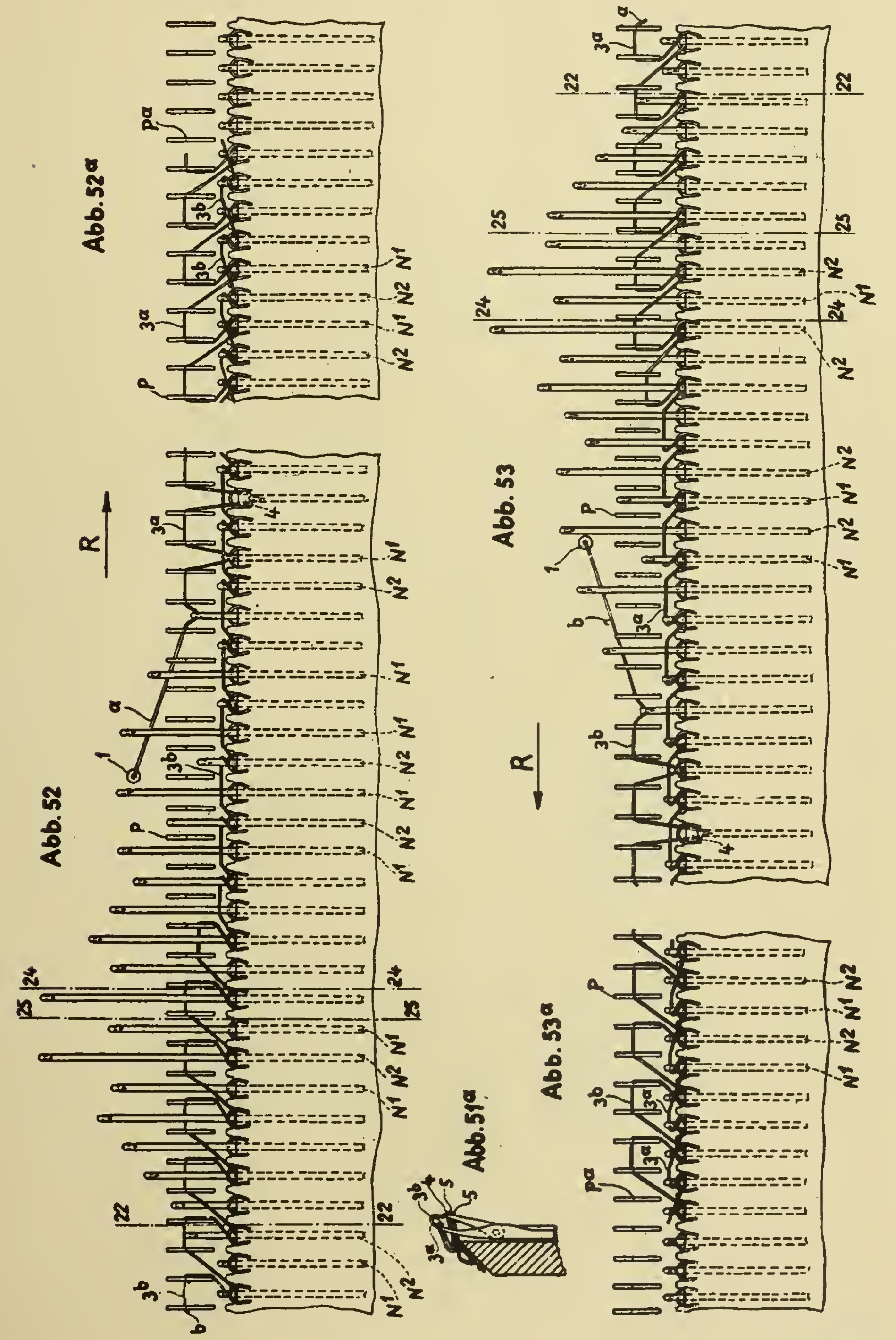

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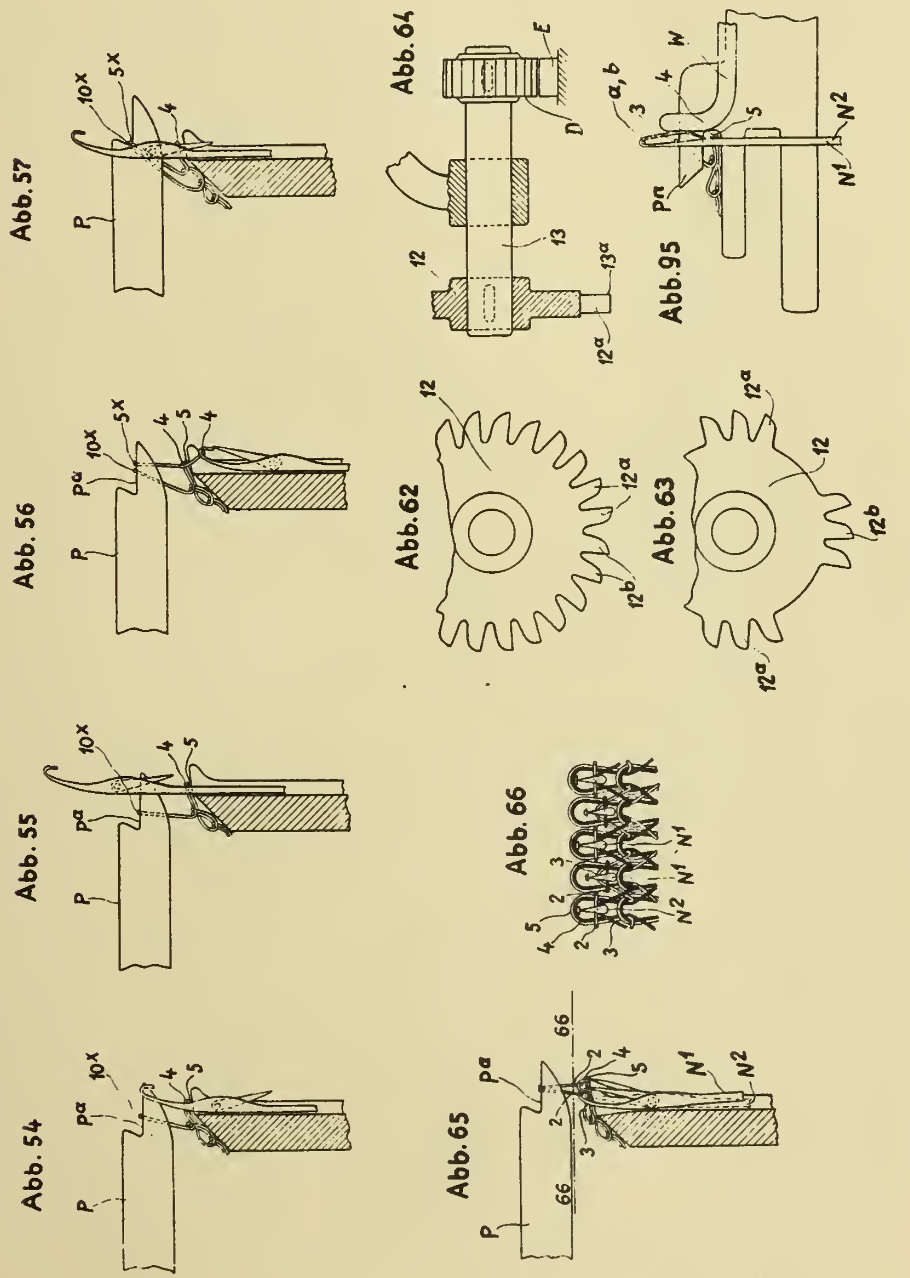

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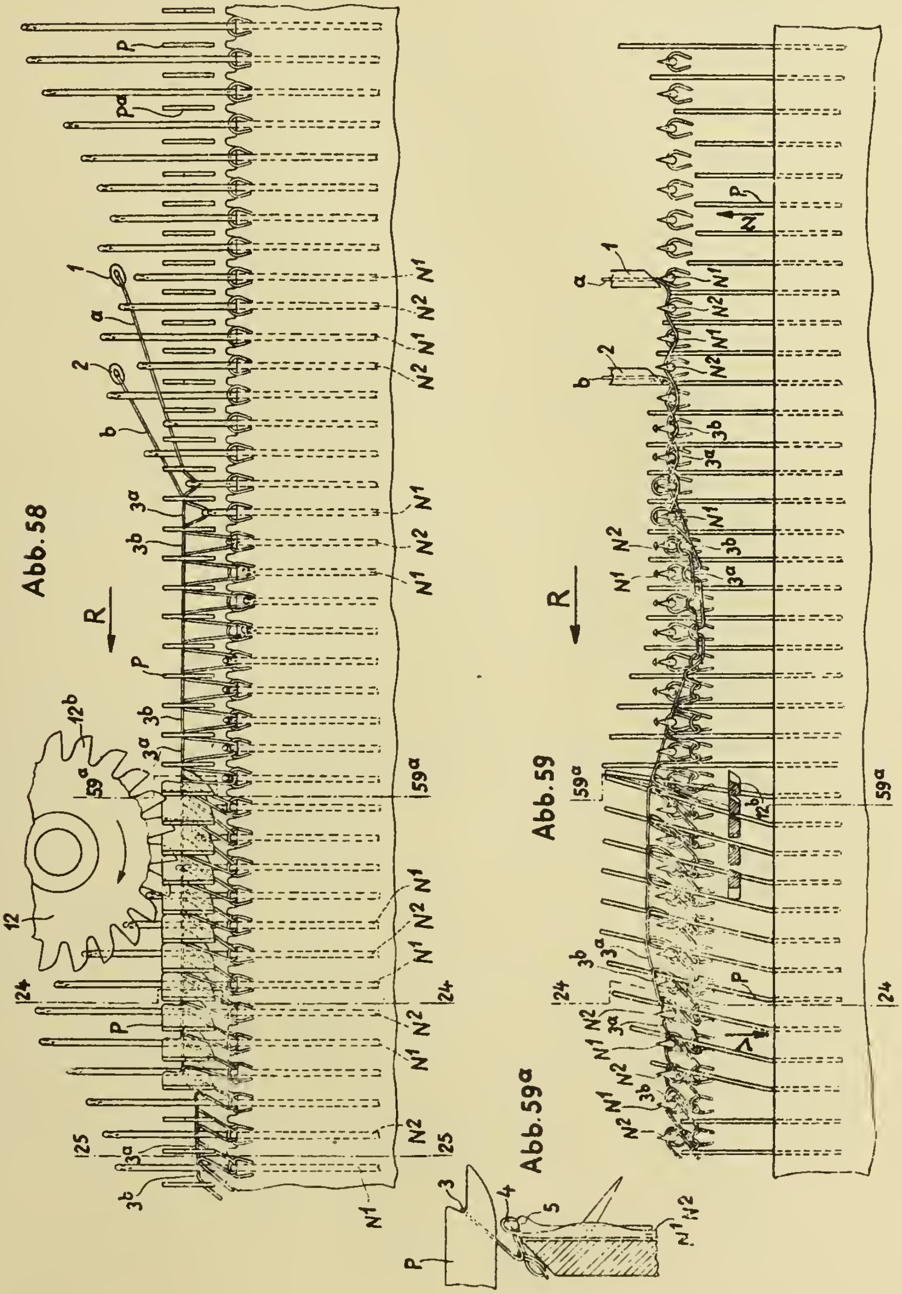

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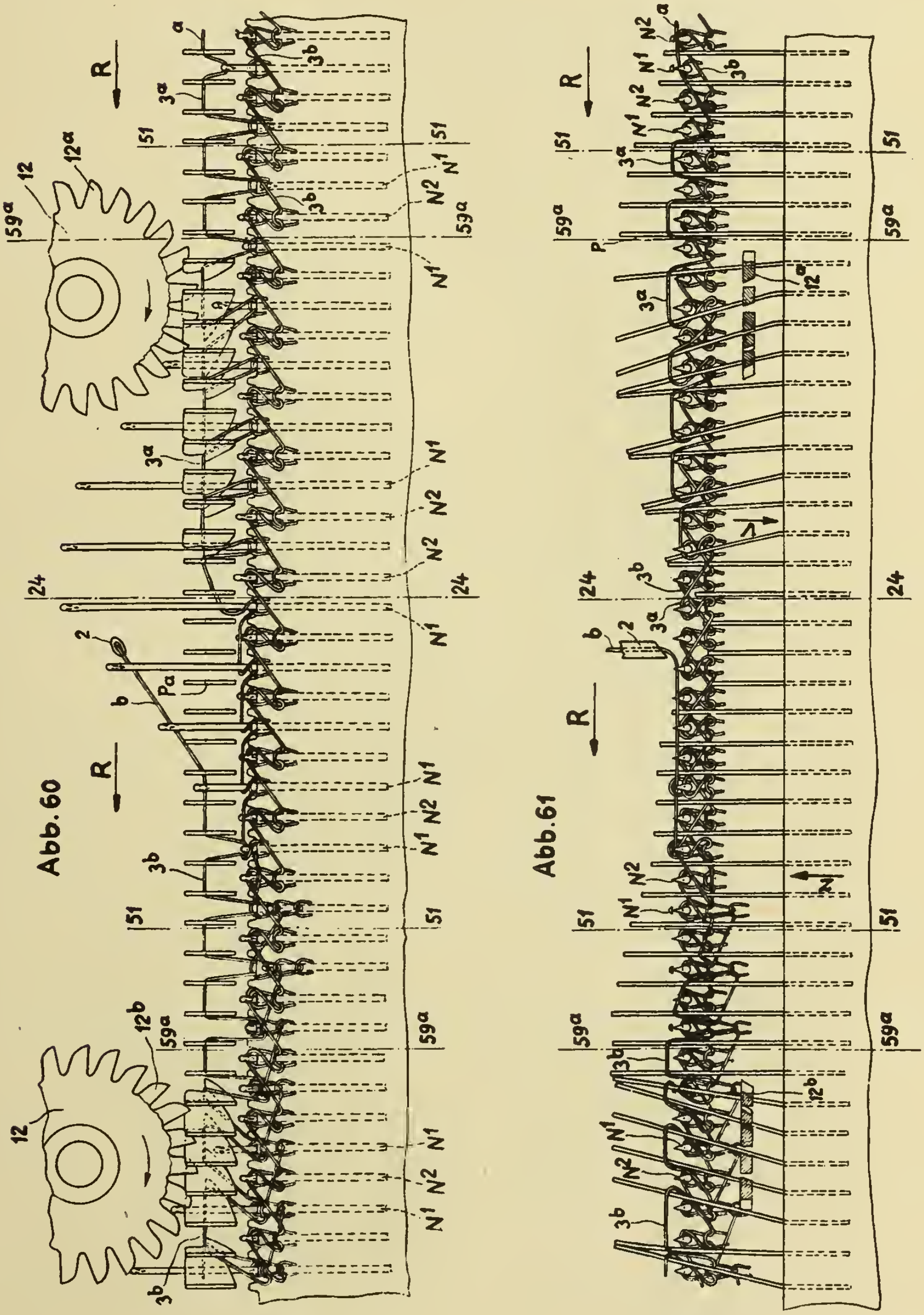

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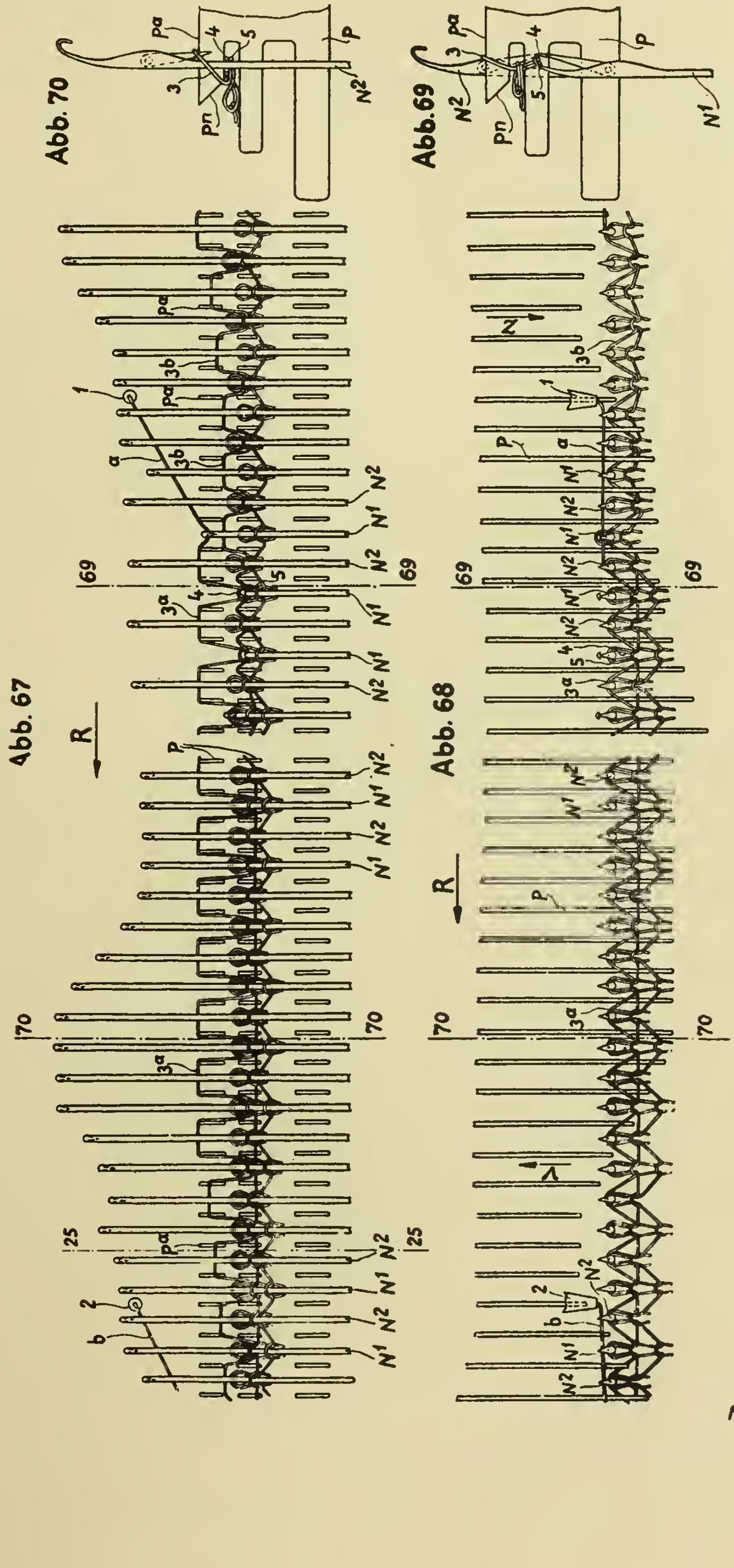

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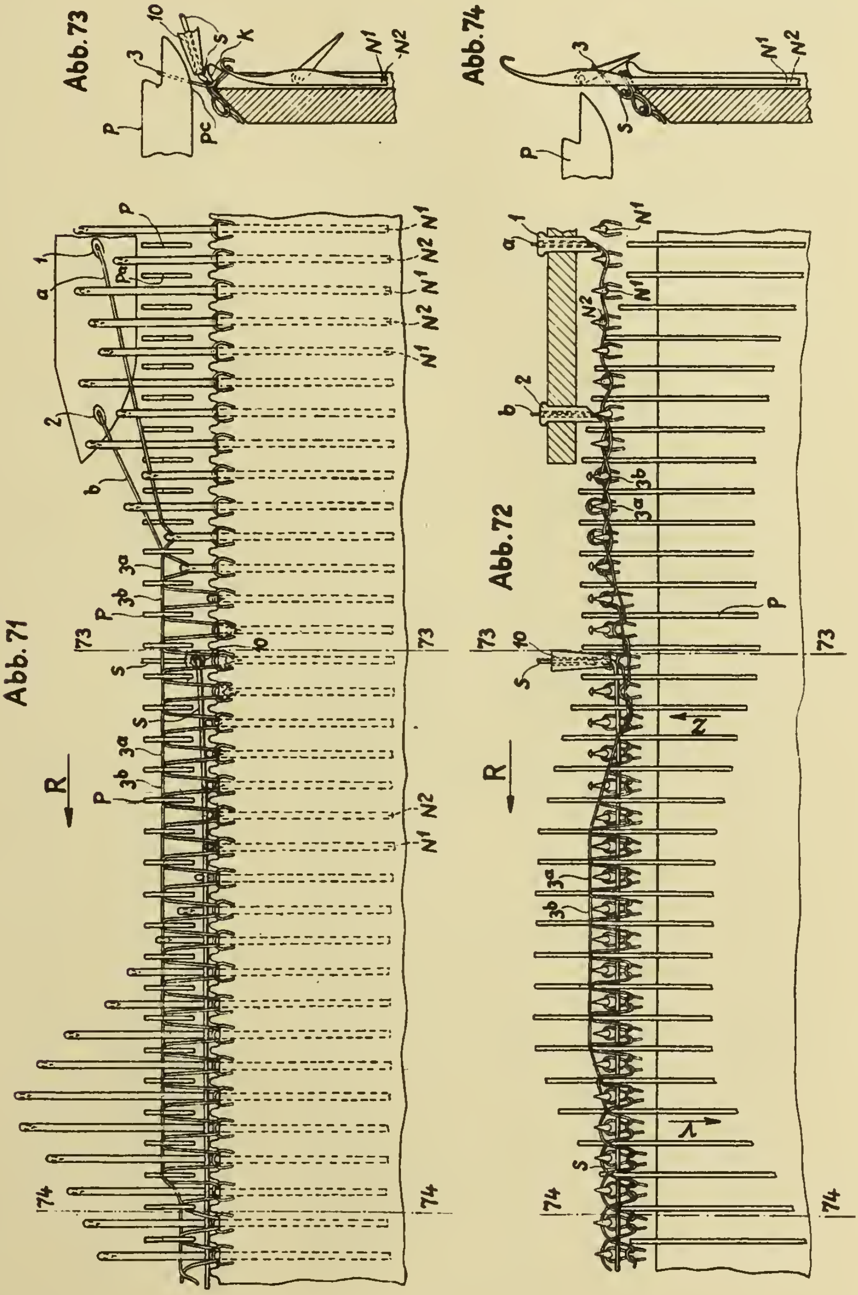

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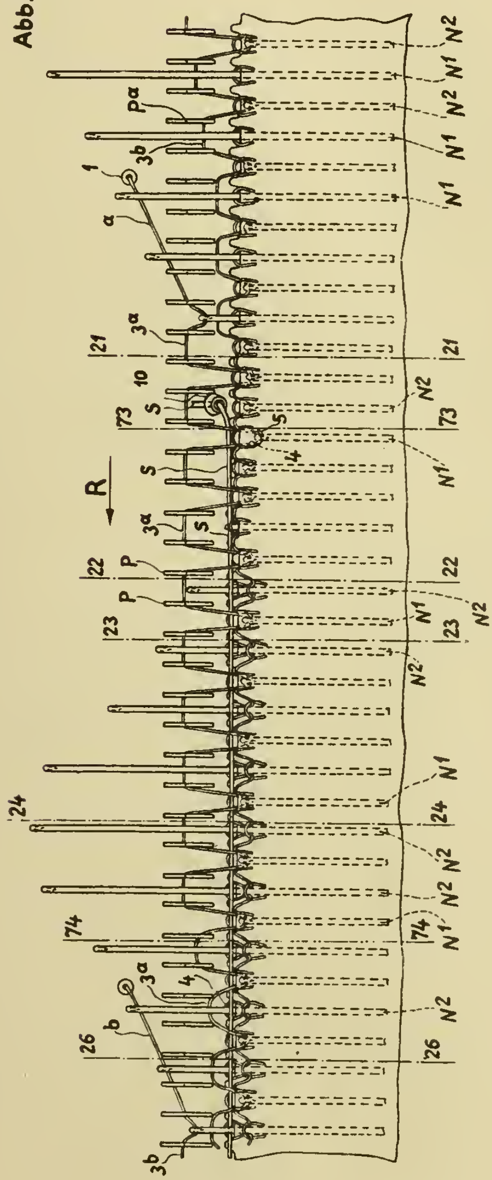

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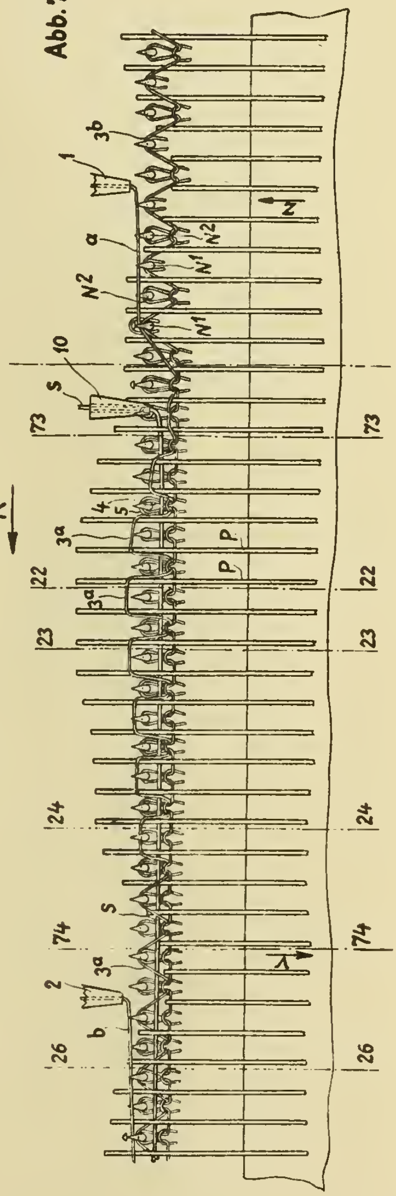


Max Nebel.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

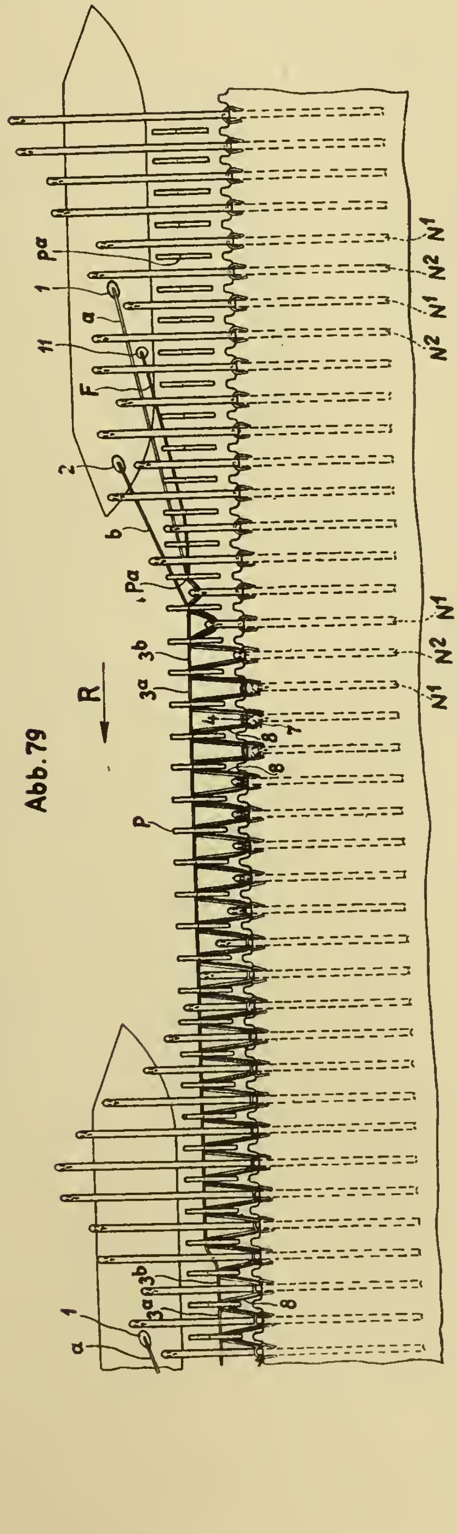
M. NEBEL

KNITTING MACHINES AND METHOD OF OPERATING SAME FOR KNITTING FABRICS

Filed Sept. 16, 1937

Serial No. 164,119

25 Sheets-Sheet 23



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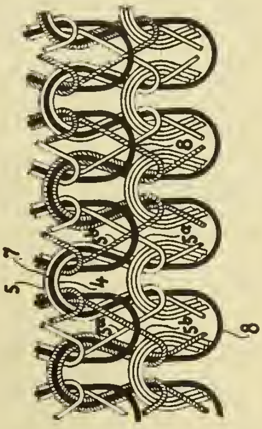

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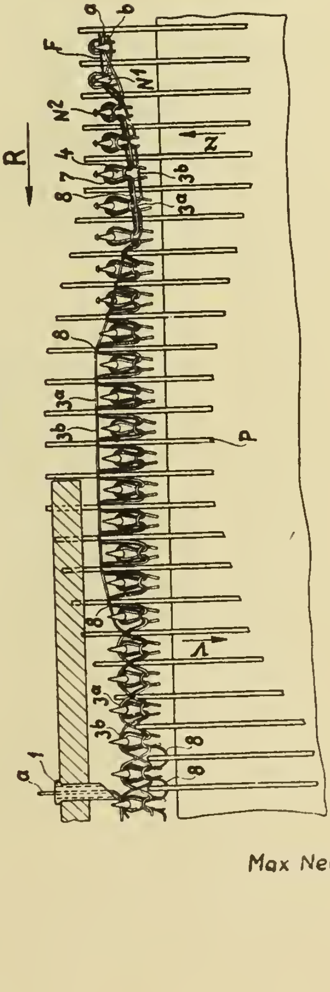

Abb. 80

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M. NEBEL

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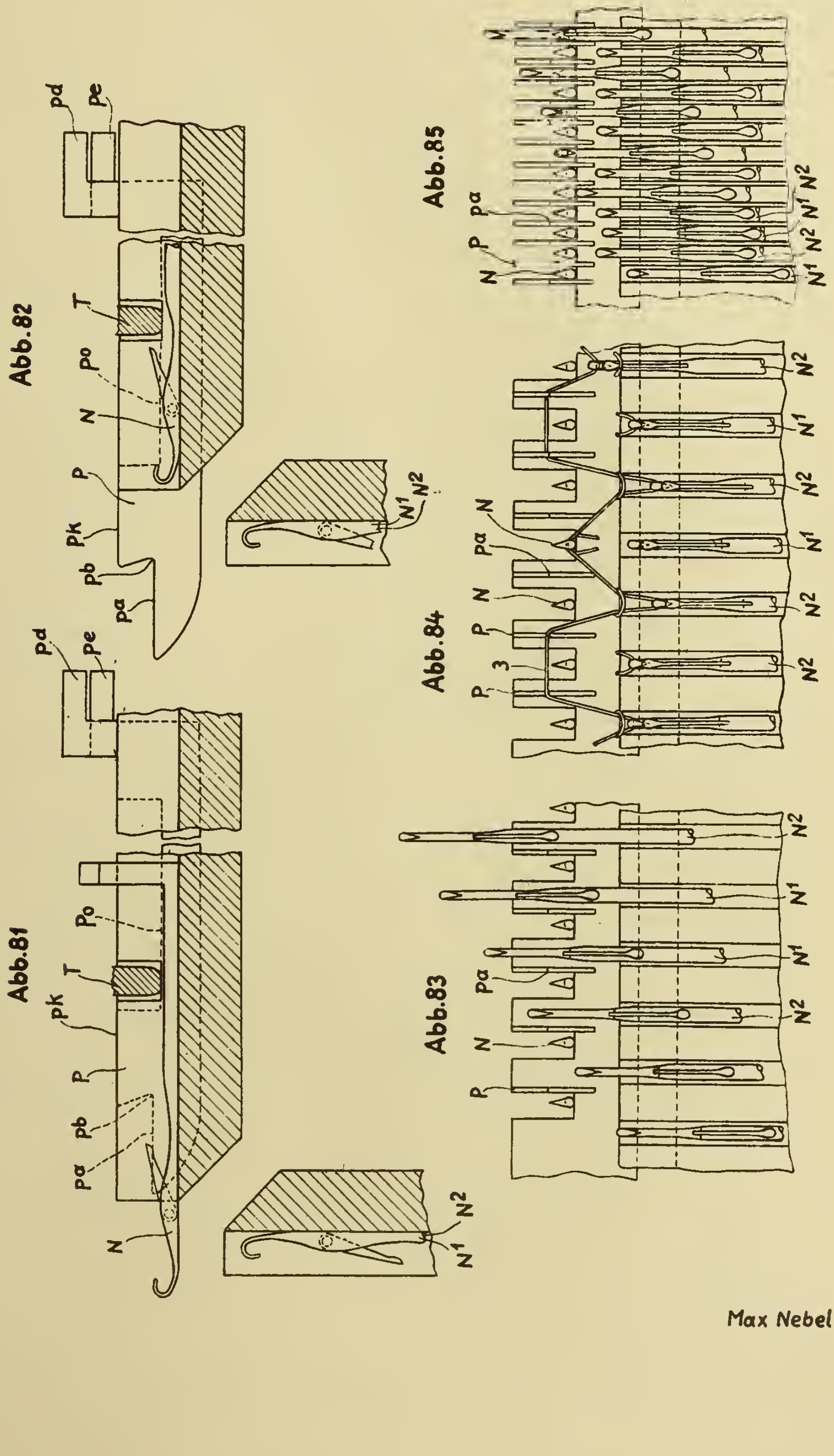
25 Sheets-Sheet 24



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M. NEBEL
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SAME FOR KNITTING FABRICS
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Serial No.
164,119½
25 Sheets-Sheet 25

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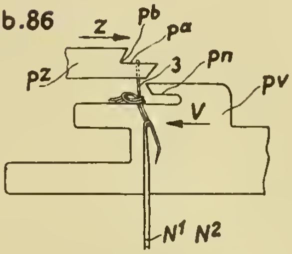

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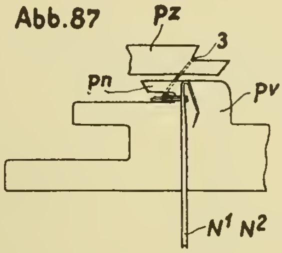

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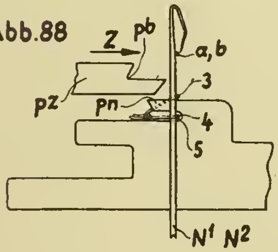

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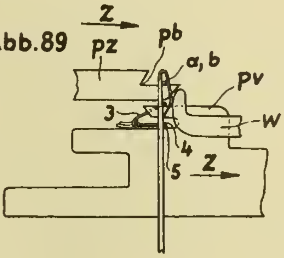

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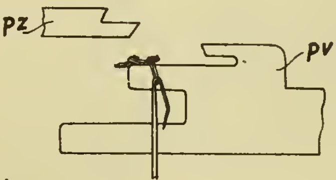

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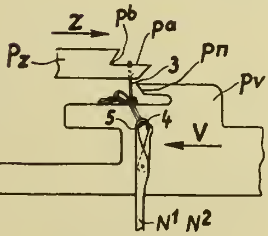

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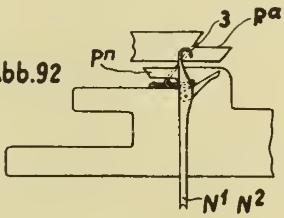

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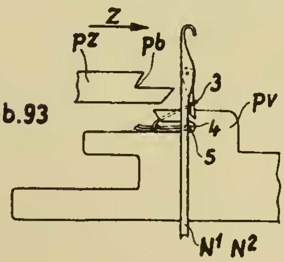

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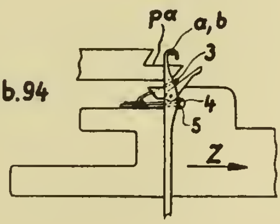

Max Nebel.

Published May 4, 1943 Serial No. 164,523

ALIEN PROPERTY CUSTODIAN

TEXTILE FINISHING PROCESS

Kurt Quehl, Zwickau, Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 18, 1937

This invention concerns a textile finishing process, improvements upon known textile finishing processes, additive features to such processes, and the improved product of such processes.

The novel process is applicable to all textile fiber and material, but more particularly to regenerated and artificial fiber, cellular wool, as well as mixed fibers and mixed fiber materials, and, above all, rayon mixtures.

It is an important object of this invention to overcome certain disadvantages which ordinarily accompany a finishing process in which a fiber or material is weighted, sized or fulled, as there are a discoloration or dulling of the colors of the material, an unstableness of weighting substance so that it dusts, etc.

But the principal object of this invention is to impart a greater resilience to textile fiber or textile material, so that the material lies flat and smooth or retains the shape into which it has been crimped or otherwise formed, and does not readily wrinkle or crease.

Other objects of this invention will be recognized from the following description.

Such objects may be obtained by using in a textile finishing process compounds which have an amorphous structure or a substantially or quasi amorphous structure with very fine crystal or compounds which have a tendency to divide out or deposit in such a formation, or compounds which have the characteristic of causing weighting compounds or other compounds used in a finishing process to yield the said formation or structure. When such an amorphous or quasi amorphous deposit is used, the pureness and brilliance of color is preserved, and, besides, the elasticity or resiliency of the fiber or material, is materially increased in practically all instances.

No absolute rule can be given in respect to the relative quantity of ingredients to be used for a finishing material of this invention; of course the substances cannot be mixed together arbitrarily; but a predetermined order may be established by way of experience and under due consideration of the weighting substance itself, as well as of the other ingredients of the finishing compound, and also of the material to be weighted. For instance, when sugar, glycerine, glue or the like is added to urea for the finishing treatment of textiles, the resulting dulling of the colors will be much less pronounced than when urea is used alone, but it is only under the best conditions that the resiliency of the material and its resistance to creasing or wrinkling will be increased to a useful extent.

A crystalline structure so fine that it appears to be amorphous, will be termed substantially amorphous herein. Really amorphous material may of course be comprised in such "substantially amorphous material."

While a strong amorphous deposit is always better than a coarse crystalline one, the crease-proofness can only reach a practical, appreciable magnitude under quite definite conditions and by the use of definite compounds, particularly inorganic salts.

An influence in this direction may be exerted by the use of very simple salts, such as sodium and magnesium sulphates, when these salts are induced to separate off in amorphous form. Other salts, such as borates and stannates as well as sodium-potassium tartrate, possess the required properties when applied to the fibers in high concentration, so that they predominate over other deposits on the fiber. The effect can be increased by the addition of substances which render the deposit on the fiber still more amorphous. But even without such additions, the increase in the elasticity and flexibility of the fibers, and thus in the crease-proofness of the material, will be of practical importance.

Agents suitable for effecting or supporting the formation of an amorphous deposit are primarily compounds which yield colloidal aqueous solutions. Furthermore there are compounds which give semi-colloidal solutions and are incapable of crystallizing. As examples may be mentioned glycerine, sugar (starch syrup), the white of eggs, glue, gelatine, starch solutions, gum arabic, gum tragacanth glycoside (tannin) and colloidal silicic acid.

Most useful are however dispersions of wax, fats, paraffin, and the like, which have a simultaneous softening effect and thus improve the feel of the material.

In most cases very little of these additional substances will be required. Exact rules cannot be given since the quantity depends on the nature of the material under treatment and of the weighting salts in use which latter differ greatly as regards crystalline properties. For each particular salt to be used, a corresponding favorable condition can be determined by anybody versed in the finishing art. According to the invention the weighting salt is, for the purpose of obtaining resilient, crease-proof material, employed in excess of other components, since otherwise the desired properties cannot be obtained with cer-

tainty. In the case of dispersions, suitable stabilizers are added.

The salts in question should be thoroughly mixed, as such or in concentrated solution, with the other components of the dispersion, the mixture being preferably homogenized. The product thus obtained can be thinned out for use in which case a better dispersion and better effect will be achieved than when the mixing is effected directly in the bath.

In the case of a paraffine mixture a certain "pearling" effect can be obtained if, in the preparation of the emulsion employed, the latter contains no wetting medium nor any equivalently acting substances. If the water repellant effect is desired, aluminum compounds must be added, or the material should subsequently be treated in a solution containing an aluminum compound.

The following examples serve to elucidate the invention, and are therefore illustrative and not limitative.

Example 1

20 parts by weight of cocoanut fat are thoroughly emulsified with 30 parts of stearine soap and 40 parts of water. 200 parts of sodium borate are added to the emulsion whereupon the mixture is worked in a ball mill into a homogeneous paste. This paste can be dissolved in warm water and forms an emulsion which may be diluted with 4 to 10 parts of water for the treatment of viscose silk. The treatment can be continued until an addition of 10 to 15% in the dry weight of the goods has been achieved.

The material thus treated will exhibit a greatly increased elasticity and offer resistance to bending, wrinkling or any other alteration in the shape it had when impregnated. Crimps or other formations of the fiber will be permanently fixed. The effect obtained with borate alone is not so favorable, although it has practical advantages. Nor will the effect by treatment with the fatty emulsion alone be obtained.

Instead of the sodium borate, other water soluble borates may be used, for instance potassium borate, ethanolamine borate or triethanolamine borate, and mixtures thereof. If the borate is entirely or partly replaced by sodium potassium tartrate, the result will be less good. A replacement by stannate will produce a better result. While these compounds will produce practically the same effect when not dispersed, the effect of the combination is better on account of the softening properties of the emulsion.

2 to 5 parts of hexadecanol may be added as a stabilizer, in Example 1. But the fatty alcohol may also take the place of the other fat-supplying bodies, for instance of the paraffin, oil or wax. Instead of hexadecanol, stearine amide or the like may be used. That combination proved particularly useful for the impregnation of material compound of a mixture of natural and cellular wool.

Similar combinations are obtained as follows:

Example 2

60 parts by weight of borate and 40 parts of Rochelle salts, or 100 parts borate or 60 parts sodium stannate, 20 parts of a weak alkaline emulsion of cocoanut fat and 2 parts gum arabic in 1,000 parts water of 50° C. The mixture is stirred until cold. A warmed solution of this mixture may be used for treating lining material of artificial silk or cotton. Material is centrifuged and dried as usual.

Example 3

100 parts by weight of water contain 70 parts of sodium-potassium tartrate and 10 parts of a paraffin or cocoanut fat emulsion. Ladies' dress material containing 70% cellular wool, can be treated with this mixture at a temperature of 45° C. The treatment is preferably carried out on a gumming machine.

Example 4

A lining material of artificial silk is treated on a foulard at 55° C with a bath containing 8% of sodium borate and 1.5% of a weakly alkaline olive oil emulsion. The material is centrifuged, dried in the usual manner, and calendered.

Example 5

Printed cotton is treated on a jigger at a temperature of 50° C with a bath containing 12% of sodium borate, 1% of a weakly alkaline paraffine emulsion, and 0.5% of gum arabic. The wringing or centrifuging and drying is effected in the usual manner.

Treatment on a gumming machine with a bath containing 5% of borate and 1% of a weakly alkaline cocoanut fat emulsion, at a temperature of 45° C is recommended for ladies' dress material composed of 70% natural wool and 30% cellular wool.

Example 6

10 parts by weight of paraffin and 10 parts of earth nut oil are emulsified in the requisite amount of water by means of 23 parts by weight of olein ammonia soap until a paste is obtained. Into this paste are worked, preferably in a colloid or ball mill, 100 parts by weight of Rochelle salt and 100 parts of sodium borate. Suitable emulsion stabilizers such as glue, or hydrophile, water insoluble compounds such as fatty alcohol (hexadecanol) or the like, may be added. By treatment with this emulsion in diluted form, artificial silk material may be increased in weight by 10% to 15%. Apart from the increased elasticity produced in the material by this treatment, the material will appear full, soft and flexible to the touch. The result is particularly good when the tartrate is omitted and the borate proportion is increased to 150 to 200 parts.

The paraffin contents of the emulsion imparts a certain depearling effect which can be increased by substituting paraffin for the oil.

Example 7

A paraffin emulsion containing 30 parts by weight of paraffin (melting point 40° to 42° C), 3 parts albumen, 1 part oxalic acid and 66 parts water is worked into a paste with 200 parts borate. In a 10% bath of this paste a cellular wool gabardine is treated on a gumming machine, centrifuged and dried. The material will appear full to the touch, the tendency of the material to crease will be considerably reduced, and the water depearling effect will be very good.

Example 8

Emulsify 25 parts by weight of paraffin, 5 parts of petrolatum oil, 3.5 parts of albumen, and 65.5 parts of water. 3% of this emulsion are added to a bath containing of 9% borate. A dress material composed of cellular wool is treated with this bath on a foulard. After centrifuging and drying, the material will be found to be highly

resistive to creasing. It also shows a good water depearling effect.

In order to render the material water-proof, 1.5 and 2 parts by weight of sodium aluminate are added to the bath. Or a waterproofing effect can be produced by after treatment in a bath containing 1% aluminun formate (12° Be).

Example 9

A 10% solution of borate is mixed with 1% starch syrup. With this solution a viscose lining material is treated on a foulard. After the usual centrifuging, drying and calendering, the material will be found to appear full to the touch and resistive to creasing.

If in this last example the borate is replaced by a water soluble stannate, the resistance of the material to creasing will be still greater.

Example 10

20 parts by weight of olive oil are emulsified together with 2 parts of castor oil soap in 80 parts of water. The emulsion is thoroughly mixed with 500 parts sodium sulphate. The product thus obtained is dissolved in 12% water and used as a bath on the gumming machine for the treatment of woolen dress material. After drying, the material will be found to be pleasantly soft and full to the touch, and the colors of the material will be clear.

The advantage as regards the color will not be obtained by the use of sodium sulphate alone. The tendency of the material to crease would also be diminished.

Example 11

A printed cotton material is treated on a jigger with a bath containing 10% of magnesium sulphate and 2% of dextrine. After centrifuging and drying the material will be found to be much more full to the touch, and there will be an 8% increase of the dry weight of the material. The colors remain clear.

By way of magnesium sulphate alone the material will become unpleasantly hard, and it will look dusty.

KURT QUEHL.

Published May 4, 1943

Serial No. 165,091

ALIEN PROPERTY CUSTODIAN

METHOD AND DEVICE FOR PRODUCING INTENSIFIED COLORS OR FOR INTENSIFYING THE PERCEPTION OF COLORS

Ferdinand Leiber, Berlin-Friedrichshagen, Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 22, 1937

The normal human eye has three specially remarkable fundamental perceptions the perception maxima of which lie near the spectral wave lengths 450, 550 and 650 mu, that is in those portions of the spectrum which usually are designed as blue, green and red. Light of one of said wave lengths is perceived always essentially by only one of the three fundamental perceptions of the eye, whereas the interposed portions of the spectrum each are perceived by more than one fundamental perception. For example, a light acting with equal intensity on the red and green fundamental perception produces the impression of a yellow intermediate color, even if at all none wave length of the yellow spectral portion exists in it. Similarly blue and green appear as a bluish green in which however always the red fundamental perception is simultaneously affected and thereby a whitish appearance of the blue-green is produced.

In optical glasses it is known to use neodym (accompanied mostly by some praseodym) as a component which effects an intensified perception of some colors but is not able to eliminate a very troublesome blue-green. In the electric light production, combinations of mercury vapour light and neon or lithium light have been proposed with partial success, but quite a number of colors became remarkably changed and obscure also in this case.

The invention consists primarily in decisively improving the light production or aperception thereby that from the object to be aperceived to the eye of the spectator or to the light sensitive photographic layer, as far as possible only light corresponding essentially to the aperception maxima of the eye is admitted. This may be done by either illuminating the object only by light having the maxima spectrum, or by looking onto it by a filter absorbing from the object illuminated by all colors, all other colors than the maxima colors. This method has the success of producing such an exceptionally strong intensification of all color differences and such a high intensity or saturation of all colors that very much details become visible or photographable which otherwise could not at all be perceived, and in seeing moreover a physiologically very animating impression is gained by the bright-colored sight.

This effect is attained in all practical cases, as the daylight as well as the emission of the usual artificial lamps contain light of all spectral portions, although of different intensities, and as also the objects appearing to the eye as purely colored in reality have mixed colors almost throughout. The few exceptions showing really unicolored light, as for example natrium light illuminations, are so seldom that eye glasses or photographic-filters corresponding to the invention also at night time have in the by far most cases their full effect. If, on the other hand, also the illumination is effected by light of the new composition, the sight is intensified not only with respect to the color differences but also to the entire light intensity.

The light absorbing filters according to the invention can not only be used in the form of eye glasses, but they can be realized by materials serving as admixtures or as basis or as covering window for the objects, for example by a lacquer or other transparent cover absorbing the minimum light regions situated between the maxima, or in pictures a covering glass or a background supporting the coloring matter or a color admixture may produce the mentioned effect. Useful materials for these purposes are below described.

A special adaptation of the new method for photographical multicolor negative and positive processes consists therein, that for the exposition an illumination is used which contains rays corresponding to the aperception maxima of the eye, and for the copying process an illumination is used which contains rays corresponding to the absorption maxima of the single coloring materials forming the negative or the positive produced by a conversion process. In this case an extraordinary brilliant success is attained, as not only the colors of the negative become precisely complementary and very saturated, but also the spectroscopic and sensitivity deficiencies of the light sensitive layer are corrected and made innoxious, as the negative (or conversion positive) has the most effective absorption for the rays to be absorbed.

Some examples of processes and devices according to the invention are as follows:

An illuminating device is combined of several electric discharge tubes producing an entire spectrum having interruptions between the aperception maxima. If precisely adapted discharge gases are available no filters are necessary and best economy is realised. Three tubes each emitting one maximum may be used, or one tube of two may emit two maxima.

Thus the red light component may be emitted from zinc vapor, or from neon and freed from yellow emission by a neodym glass filter. Blue and green may be emitted from mercury vapor

which also by a neodym glass filter is freed from yellow rays, and in case of necessity is freed from a troublesome blue-green emission. In this case it is also possible to use mercury only for blue and thallium for green, both discharge tubes being provided with filters absorbing the undesired rays.

Similarly incandescent lamps can be used. For example, three lamps are each provided with a filter excluding all other rays than those in near proximity to the desired aperception maximum. Blue maximum light is produced by aid of a filter of Schott glass BG 6 one mm thick or BG 12 two mm thick, red maximum light by Schott glass RG 5 two mm thick, and green by Schott glass OG 4 two mm thick combined with BG 18 two mm thick. All three lamps project their rays simultaneously onto the object, and their intensities are so regulated that the entire light appears white.

Instead of glass filters, liquid filters or solid solutions of coloring matters in gelatine or the like can be used. The organic dyestuffs give for this purpose an extraordinary ample choice, and in consequence of their (in some cases) very steep absorption curves the energy can be economically made use of.

Some light filters give the possibility of using the light of one lamp at once for two maxima. For example, acid rhodamine (rhodamine S, USA-Patents 402,436 and 425,504; Farbstofftabellen of Gustav Schultz, volume 1, Berlin 1932, Nr. 570) diluted in water or gelatine lets pass the red and blue rays at once. A second lamp or tube is then used for green maximum light.

Neodym glass (absorbing -580 mμ) and a filter containing the yellow coloring matter tartrazine (tartrazine, USA-Patent 324,630; Farbstofftabellen of Gustav Schultz, volume 1, Berlin 1932, Nr. 23) or a Schott glass OG 4 two mm thick (absorbing 500 mμ) allows to produce a light corresponding to the red and green maxima. If a second lamp is filtered to give blue light, for example by Schott glass BG 6 or BG 12, and the intensity of both lamps is brought into optical equilibrium, then also a light according to the invention is gained.

One single lighting body may produce all three maxima. Until now, a similar simplification is possible by aid of other light sources being near. For example, a mercury vapour tube is filtered so as to give the two maxima pure blue and pure green, and reddish light coming from usual road or house lamps aids to make an entire light of useful spectroscopic qualities, although in no way as good as with full use of the invention.

For aperceiving objects enlighted by daylight or other multicolor of omnicolor light, as for example from unfiltered incandescent lamps, all the above mentioned filters may be used as spectacles or the like, provided only that as far as possible only small regions of rays besides the three maxima are allowed to pass in essential quantities.

For producing the maxima colors immediately on the objects, the undesired rays about 580 mμ may be absorbed by neodym oxide (in molten glass), or neodymium nitrate or other neodym compounds soluble in water or in other usual solvents (for coverings of laquer type), for example also in gelatine, collodium or oil laquer. The undesired rays about 500 mμ may be absorbed by monobrom-fluorescein which in the group of the cosines has a specially low molecular weight. Similar other materials, as for example succinyl-fluorescein or the halides thereof may also be used, as well as other materials still to be searched by aid of spectroscopic tests.

A further example of a coloring or filtering substance for absorbing the two light minima near 490 mμ and 590 mμ is described as follows:

3 gr 6-Chlorbenzoxazol (Amer. Journal 1932, page 42, or Bulletin de la Société Chimique de France, IV, Vol. 133, page 1828) are heated to about 100° C together with 2 cm^3 jodmethyl during 8 hours in a tube, then broken and washed with acetone and thereafter with water and recrystalled from absolute alcohol. The product is a 6-Chlorbenzoxazol-jodmethylate, and 2,5 gr of this product are dissolved in 20 cm^3 dry pyridine and after addition of 3 cm^3 ortho-formic-acid-ester heated for one hour. The crystals thereby produced are after cooling removed and recrystalled from alcohol. Thus a 5,5′ dichloroxacarbocyanine-jodmethylate is gained, which absorbs the light from 480 to 510 mμ and forms the first component of the entire coloring substance.

Further (according to British Patent 344,409, Imperial Chem. Ind. Ltd., London) 0,43 gr raw 2′-*w*-acetanilido-vinyl - benzthiazol - jodethylate are cooked with 0,3 gr chinaldine-jodethylate and 2 cm^3 dry pyridine during 25 minutes. Green crystals are therefrom produced by cooling and after separation recrystalled from alcohol. They are an 1,1′-diethyl-2-chinoline-2-thiazol-carbocyaninjodide, which absorbs the light from 580 to 600 mμ.

Both described substances are dissolved in acetone, the first at a grade of 0,25% and the second 0,02%, and about 50 gr of each solution are added to 400 gr acetyl cellulose (Kahlbaum) and 2400 gr acetone under slight heating. This product is then fused on a glass plate for serving as a light filter according to the invention. Its separate constituents and other coloring matter produced under similar views may also be used for coloring any objects or photographic layers or for painting pictures.

Where a color basis is to be got from only two colors, for example a fabric having differently colored chain and stay filaments, one series of said filaments may be green so as to absorb the whole spectrum excepted 510 to 570 mμ, and the other series may be red so as to absorb the whole spectrum between 490 and 590 mμ.

For example the stays may be colored by rhodamine and the chains by patent blue mixed with tartrazine or any other coloring means reflecting only between 510 and 570 mμ.

In the use for making photographic multicolor pictures, the new method consists in illuminating the object by a light corresponding to the aperception maxima of the eye. The negative thus produced, is with special preciseness complementary to the colors of the object. If said negative consists, as usual, of three color layers representing red, green and blue respectively, or also if separate negatives each containing one of said layers are produced, the positive copying process is effected by a light containing mainly rays of that spectroscopic portions which correspond to the absorption maxima of the single colors of the three color negative. This may be effected by light mixed in the above mentioned way, or the different lights may be applied after each other.

In case a single color of a negative has an absorption spectrum which is very different from the sensitiveness spectrum of the appertaining (complementary) single color portions of the posi-

tive, it is often advantageous to make the positive by aid of light rays which do not precisely correspond to the absorption maximum of the negative color but to a relative maximum of absorption. This relative maximum of absorption is a combination of the absolute maximum of absorption and of a complementary maximum of sensitiveness in such way that with relation to the sensitiveness of the positive layer the best absorption in the negative layer is attained. This means that the light elements to be absorbed are specially completely absorbed, as the light rays used nearly correspond to the absorption maximum and at once to the sensitiveness minimum of the layer for the undesired color.

A practical example is as follows: a multicolor object is illuminated by a light mixed from mercury vapor and neon discharge and filtered by neodym glass, and photographed either on three single color negatives or on a combined three color negative of the Kodachrome or Agfacolor type, similar to that described for example in German patent 257,160. This negative may then be converted into a positive by usual exposing (without fixation), developing by a special developer whose oxides chemically produce the colors from the different constituents of the layers. and freed from silver. The positive thus gained has a special brilliance as all its portions specially well correspond to the aperception maxima of the human eye. This brilliance can still be augmented by illuminating this picture by a light corresponding to that used for the exposure.

On the other hand, the negative, instead of being converted into a positive, may be completed to a complementary color negative by being developed by the said special developer. This brilliant color negative, in contradistinction to the known negatives of the mentioned type, which are not able for positive reproduction, is very well adapted to be copied, as its colors are already purified and higher saturated. Now, a copying light is composed of that spectral portions which correspond to the absorption maxima of the single color elements of the negative, eventually with a deviation towards that color group which are the least sensitive for the complementary troublesome color of the positive color to be reproduced. In this way from the complementary negative, a positive is gained which by the double correction of the spectroscopic deficiencies of the coloring and sensitizing matters is free from the detrimental incorrectnesses arising without the use of the invention. Also this positive still gains when contemplated in light according to the invention.

In the same way it is also possible to copy a negative from a positive produced by conversion from a negative, or a positive by conversion of the first mentioned negative.

In all cases, objects being at rest can be photographed also by subsequent application of the single maximum lights instead of by the simultaneously applied mixed lights. The same is true for copying the positives.

FERDINAND LEIBER.

Published May 4, 1943

Serial No. 166,172

ALIEN PROPERTY CUSTODIAN

RAILROAD GUNS

Felix Skora, Dusseldorf, Germany; vested in the Alien Property Custodian

Application filed September 28, 1937

In railroad guns it is known practice to support the vehicle frame carrying the gun by means of platform supports which can be lowered to bear on the rails or on specially provided auxiliary foundation plates or bases. It has also been proposed to lower the vehicle frame at prepared parts of the railroad lines, either onto rigid platform foundations or on to turntables and to fix the frame, by means of screws or clamping members, to the rails or other parts of the platform for firing.

An object of the invention is to arrange that the rails shall form the gun platform or emplacement and thus permit firing at any desired part of the line without the necessity for tiresome measures such as screwing or keying the vehicle frame to the platform.

With this object in view, the bottom surface of the vehicle frame, which is adapted to be lowered from the pivoted trucks or bogies, which comes into contact with the rails, is covered with an elastically deformable material capable of providing great frictional resistance, for example rubber which has been vulcanized in suitable manner or reinforced with a fabric insert, and which under the load of the frame carrying the gun presses against the head of the rail and thus provides a sufficient bearing and frictional surface for firmly supporting the gun while it is being fired. In order that the necessary stability should also be obtained when the gun is fired in directions transverse to the longitudinal direction of the rails, according to a further feature of the invention there are provided on the longitudinal sides of the frame struts adapted to be positioned transversely to the longitudinal sides of the frame and which each comprise a platform plate or shoe and a tensioning member adapted to be adjusted in respect of its length and the force it applies.

An example of construction of a railroad gun according to the invention is illustrated in the accompanying drawings wherein

Fig. 1 shows diagrammatically a side elevation of the railroad gun in travelling position,

Fig. 2 shows on a larger scale a rear view of the gun in firing position, and

Fig. 3 is an enlarged partial sectional view of details of the construction.

Referring to the drawings, the frame A which is rigidly connected with the gun mounting is adapted to be lowered from the pivoted bogies B, C which carry it in travelling position, in order to bring the gun into the firing position, in which position the frame A bears upon the rails. The base surfaces of the longitudinal frame member A_1 are provided with a longitudinally extending covering of relatively easily deformable, elastic substance H_1, for example rubber, capable of affording greater frictional resistance, and this covering, when the member A_1 is lowered on to the rails, is pressed, by the weight of the gun, gun carriage, and the frame A about the head of the rail, thus producing sufficient adhesion to firmly support the gun while it is being fired.

In order also to provide a sufficiently stable support for the lowered frame when the gun is fired in a direction transversely to the longitudinal direction of the rails, there are provided at the side walls of the frame A transverse supports which comprise shoes K having struts J jointedly connected thereto and to pivots D, E on the frame and adjustable links L the length of each of which is adapted to be varied by means of a turnbuckle M. Each said adjusting link engages with a pivot pin on a shoe K and is attached at the other end by means of a hock N in a lug F or G on the longitudinal frame member A_1.

In order to transfer the gun from travelling into firing trim, the frame A is lowered from the saddle bearers on the bogies B, C until its load is carried completely by the rails, the struts J are then swung sideways about the pivots E and secured by tightening the respective links L. The recoil forces which occur in the direction of the rails are taken up by the frictional resistance of the covering H_1 on the bottom surface of the longitudinal frame member A_1, while when shots are fired at right-angles to the direction of the rails, the traverse supports J, K. L act on the recoil side of the frame and prevent tipping while when firing in intermediate directions the resulting forces are shared by the covering H_1 and the transverse supports J, K, L.

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F. SKORA
RAILROAD GUNS
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Serial No.
166,172

Fig. 1.

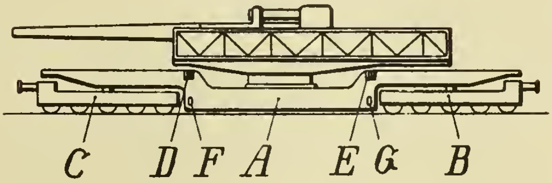


Fig. 2.

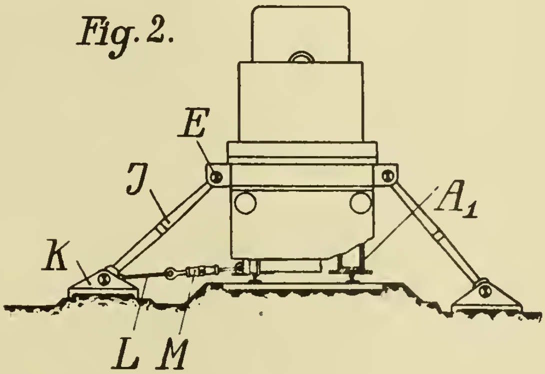
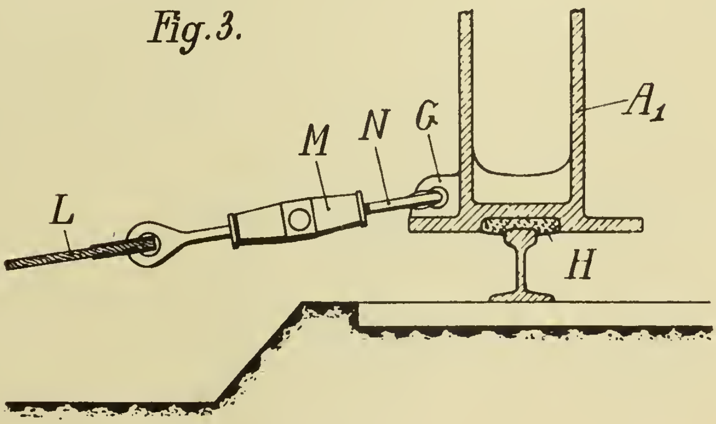


Fig. 3.



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ALIEN PROPERTY CUSTODIAN

HIGH SPEED STEEL

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No Drawing. Application filed October 26, 1937

Tests run with the object of substituting tungsten in high speed steels by molybdenum disclosed the applicability of the thumb rule, that 1% molybdenum can replace 2% tungsten. There are e. g. steel grades known, containing about 8–9% molybdenum instead of 18% tungsten, yet showing an equally good cutting ability. Particularly well-known are the results of steels with approximately 0.7% carbon, 8–9% molybdenum, 3–4% chromium, 0.5–1.0% vanadium, offering the same ability to hold the cutting power as steels with 18% tungsten and otherwise same alloying constituents.

According to the invention, it is by no means necesssary to maintain a molybdenum-tungsten ratio of 1:2. Steels equalling in quality the tungsten steel grade are obtained already at considerably lower molybdenum contents. According to the invention these steels are composed of 3–4% molydenum and eventual additions of tungsten up to 3%, vanadium up to 3%, cobalt up to 20%. An example is quoted hereafter indicating that as a result of comparative tests a steel with

	Per cent
Carbon	0.79
Silicon	0.18
Manganese	0.27
Chromium	3.66
Tungsten	1.84
Vanadium	0.64
Molybdenum	3.45

offered favourable results as compared with a steel composed of

	Per cent
Carbon	0.68
Chromium	3.68
Tungsten	15.00
Vanadium	0.54

A practical comparison test revealed the following service life:

	Strength of material	Hardening temp.	Depth of cut	Feed	Speed	Service life
1st test series	*Kg/mm²*	°C.	*Mm.*	*Mm.*	*M/min.*	
W—Steel	93	1270/80	3	2.12	12	63′ 30″
Mo—Steel	93	1210/30 1260/70	3	2.12	12	82′ 20″ 82′ 00″
2nd test series						
W—Steel	93	1270/80	3	2.12	14	36′ 00″
Mo—Steel	93	1220/30 1250/60	3	2.12	14	35′ 45″ 36′ 20″
3rd test series						
W—Steel	93	1280/90	3	2.12	15	22′ 05″
Mo—Steel	93	1225/40	3	2.12	15	24′ 00″

The steels offer the further advantage that they can be hardened within a temperature range of 1200–1260° C without noting, practically speaking, an influence upon the cutting power, whereas in the case of other High Speed Steels including the Molybdenum Steel referred to herebefore, variations in temperature of 10–20° C have a great bearing on the ability to hold the cutting power.

The substitution of large quantites of tungsten by a small amount of Molybdenum is of vital importance to countries lacking the said raw materials.

FRANZ RAPATZ.
HANS POLLACK.

Published May 4, 1943

Serial No. 176,335

ALIEN PROPERTY CUSTODIAN

CARTRIDGE BELTS

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Application filed November 24, 1937

The present invention relates to cartridge belts and more particularly to cartridge belts of the kind comprising individual members which are hingedly connected with each other and are provided with devices for holding the cartridges.

Cartridge belts of this kind have previously had the great disadvantage of being unwieldy since the size of the members of the hinge connection was too great. When the size of the members was made too small, this resulted in the diminution of the strength of the belt, since the belt stretched lengthwise and the individual members became deformed, thus causing the cartridges not to be held securely in the belt in the correct position. The incorrect positioning of the cartridges in the belt caused stoppages and disturbances on firing, so that, in this way, the efficiency and the certainty of operation of the firearm was affected.

These disadvantages are avoided by the cartridge belt made according to the present invention by reason of the fact that the members of the belt, in addition to having the openings which enable the cartridges to be pushed out, form an uninterrupted pocket, the hinge parts being arranged directly on the pocket and forming a continuous extension of the pocket. According to a further feature of the invention, the hinge parts, which are arranged directly on the pocket for holding the cartridges, are formed by the material which is rigidly connected with the pocket and stiffens the latter.

Each of the members of the cartridge belt according to the invention is not only simple in construction but is sufficiently stiffened with regard to its production so that it is strong and does not become deformed. The arrangement of the parts of the hinge connection directly on the pocket not only contributes to increase in strength but, owing to the diminution of the size of the members to the smallest possible amount, the most favorable possibility of piling up the belts is obtained.

In order that the present invention may be clearly understood and readily carried into effect, the same will now be described more fully, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is an isometric view of part of a cartridge belt embodying the invention,

Figure 2 is a front elevation of one of the members of the belt,

Figure 3 is a longitudinal section of the member taken at right angles to Figure 2,

Figure 4 is a plan view corresponding to Figure 2,

Figure 5 shows the blank from which the member is produced,

Figure 6 is a front elevation of a modified form of member,

Figure 7 is a longitudinal section taken at right angles to Figure 6,

Figure 8 is a plan view corresponding to Figure 7,

Figure 9 is a front elevation of a further modified form of member,

Figure 10 is a longitudinal section taken at right angles to Figure 9,

Figure 11 is a plan view corresponding to Figure 10,

Figure 12 shows the blank from which the member is produced,

Figure 13 is a section taken on the line II—II of Figure 12, and

Figure 14 is a section of the blank after the formation of the hinge connection of the members and before the formation of the actual pocket.

Referring to the drawings, the cartridge belt consists of individual members which are provided with devices for holding the cartridges and are hingedly connected with each other by pivots.

The device for holding the cartridges forms a pocket 1, Figures 1 to 5 which is made of metal, such as sheet steel, and surrounds the cartridge. The pocket conforms to the shape of the cartridge and forms the surface of a truncated cone which is open throughout the whole length thereof to permit a part of the breech mechanism to push the cartridge out of the belt during firing.

The pocket is provided, on one side of the opening 2, with two eyelets **3** and 3′ for the hinge pivot, as shown in Figure 4, the said eyelets being arranged on the front and rear ends of the pocket and being separated from each other only by the distance *a*. Between the eyelets **3** and **3′** there is inserted an eyelet **5** of the adjoining member when the belt is being put together and a pin **4** is passed through the eyelets, the said pin being prevented in known manner from falling out. There is thus formed a pivot by which the members are hingedly connected together.

The eyelets **3** and **3′** lie close to the outer surface of the pocket since they are formed by pressing out of the same metal sheet as the one of which the pocket consists. The eyelet **5**, on the other side, likewise lies close to the outer surface of the pocket and is formed by pressing together the strip **6** which surrounds the pocket

for the width a and is rigidly connected therewith by riveting, welding or the like. The strip 6 stiffens the pocket and is, for this purpose, provided with arcuate-shaped corrugations 7 which are formed concentrically with the axis of the pocket.

The pocket is provided with means for fixing the cartridge that has been pushed therein. This means may consist of a projection 10 which engages the bead of the cartridge, as shown in Figure 3.

The member with the eyelets and the stiffening strip are produced from a piece of sheet metal such as sheet steel. The blank, from which the member is produced, is illustrated in Figure 5. It consists of a plate 15 provided with an enclosed rectangular cut-out portion 16 of the dimensions a, b. On the sides of this cut-out portion there remain of the plate two solid rectangles 17 and 17′ of the dimensions b and c. The pressed-out eyelets are then separated from each other by the dimension a of the rectangular cut-out portion 16. The plate 15, of a length l, continues on one side into a tongue or extension 18 of the same length l and of a width a. From the tongue or extension 18 there are pressed out, on the one hand, the eyelet 5 and, on the other hand, after previously rolling the plate 15 to form the pocket 1, the stiffening strip 6 which embraces the pocket on the whole periphery thereof so that it engages between the eyelets 3 and 3′. Pressed out in the plate 15 is a projection 12 which forms in the pocket 1 the member 10 for securing the cartridge. There are then pressed out in the extension 18 parallel ribs which form the stiffening elements of the strip 6.

The modified form of member illustrated in Figures 6 to 8 is adapted for the putting in of edged ammunition. The said member is formed in the same manner as the member for the beaded ammunition, but, instead of one projection 10, there are formed two projections 10′ and 10″, the projection 10 being formed lower for the purpose of facilitating the pushing of the cartridge into the belt. The cartridge case engages with its edge in the depression between the projections 10′ and 10″ and is thus held in the belt. On the opposite end, the pocket is provided with two pressed-out projections 22 and 22′, Figures 6 and 7, which serve to hold the cartridge in a position which permits of its being introduced into the cartridge chamber easily and without disturbance.

In the further modification illustrated in Figures 9 to 14, the cartridge belt member, as shown in Figure 9, forms the pocket which, except for a longitudinal opening 24, encloses the cartridge case, the said longitudinal opening being formed for the purpose of enabling the movable breech part to push the cartridge out.

The formation of the eyelets for the hinge connection can be seen from the sheet metal blank illustrated in Figures 12 to 14. The blank consists of a plate 30 which is cut out on one side in such a manner that two right-angled pieces 31 and 31′ are formed, the vertical sides of which are at a distance a from each other. On the opposite side, the plate is cut out in such a manner that a U-shape is formed in which the vertical sides are in the extension of the vertical sides of the opposite right angled pieces 31, 31′.

The width b of the sides as well as the vertical angles and the U-shape are such that they are sufficient for the formation of the hinge connection. The horizontal sides of the right angled pieces 31, 31′ as well as of the U-shape are likewise disposed at a distance b from the edge.

An eyelet 27 is formed by pressing out the material 32 between the vertical sides 31 and 31′ and eyelets 26 and 26′ of the hinge connection, Figure 14, are formed from the rectangles 33 and 33′ on the two sides of the vertical sides of the U-shape.

On the pressing of the eyelet 27 as well as of the eyelets 26 and 26′, the strips 34 and 34′ are displaced through the width b, which strips lie at this width above the horizontal sides of the right angled pieces 31 and 31′ and beneath the horizontal side of the U-shape and come in front of the rectangular projections 36 and 36′ and the rectangular projection 35, as shown in Figure 14. The strips 34 and 34′ then lie in the same plane as the middle part of the plate 30, whilst the rectangular projections 36 and 36′ and the rectangular projections 35 are bent out and come on the side of the plate on which the eyelets are formed.

After rolling and pressing together the plate to form the pocket 25, the said strips 34 and 34′ form the continuation of the pocket so that the latter, except for the opening 24 for the part of the breech mechanism which pushes the cartridge out of the belt, is not interrupted by any opening which might be produced by the using of the corresponding parts of the material of the plate 30 for the formation of the eyelets of the hinge connection.

The projections 36 and 36′ and the projection 35 then form the outer stiffenings of the pocket, especially at the positions of the hinge connection and on the edges of the pocket at the opening 24, so that the member produced is especially strong and withstands considerable strain without becoming deformed.

The cutting of this member is simple and without waste of material. The pocket may then be provided with stiffening ribs or with means for grasping the cartridge case at the bead or at the edge as illustrated in Figures 1 to 8.

JOSEF VESELÝ.

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MAY 4, 1943.
BY A. P. C.

J. VESELÝ
CARTRIDGE BELTS
Filed Nov. 24, 1937

Serial No.
176,335
2 Sheets-Sheet 1

Fig. 1.

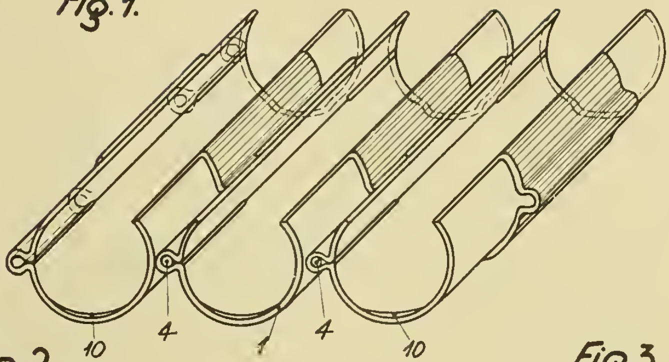


Fig. 2.

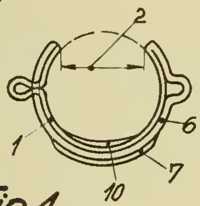


Fig. 3.

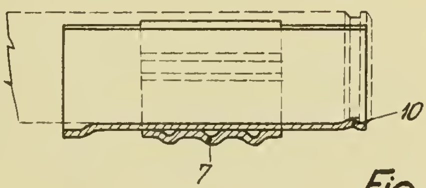


Fig. 4.

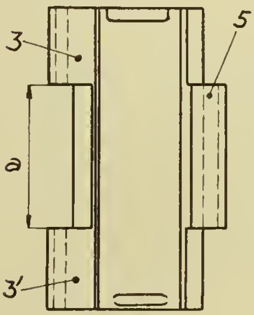


Fig. 5.

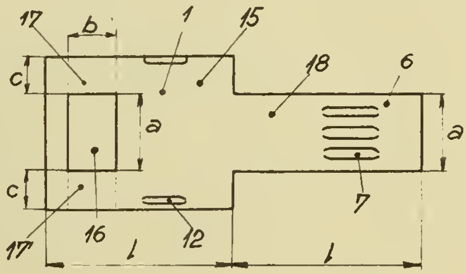


Fig. 6.

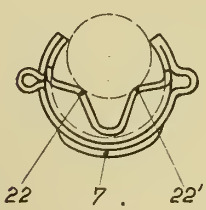
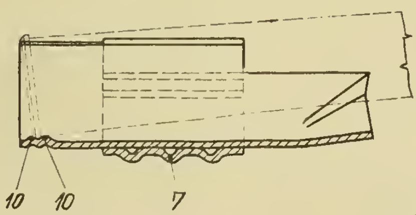


Fig. 7.



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2 Sheets-Sheet 2

Fig. 8.

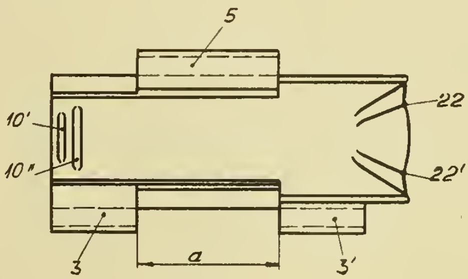

Fig. 9.

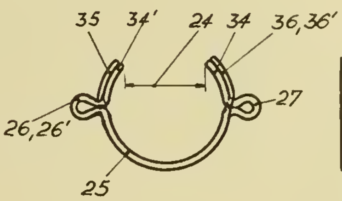

Fig. 10.

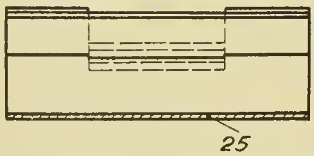

Fig. 11.

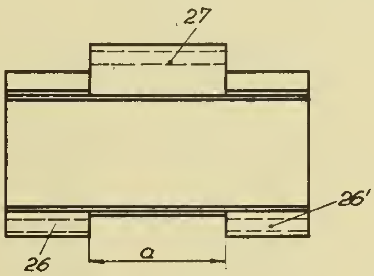

Fig. 12.

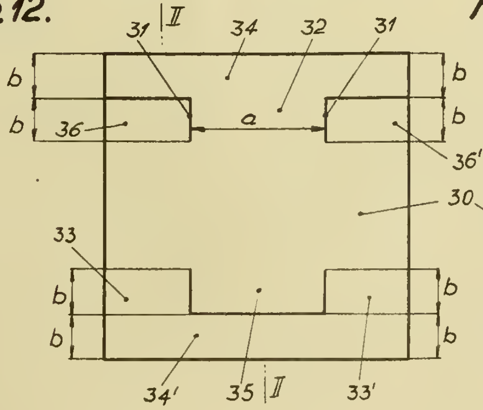

Fig. 13.

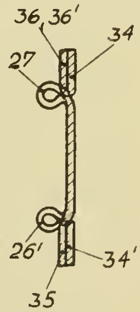

Fig. 14.

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ALIEN PROPERTY CUSTODIAN

PROCESS OF ENSURING NORMAL CURDLING OF MILK AND NORMAL ACIDIFICATION OF MILK, CREAM, CURD AND CHEESE

Georg Friedel, Dresden, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 24, 1937

This invention relates to a process for ensuring normal curdling of milk and normal acidification of milk, cream, curd and cheese.

Proper fermentation of lactic acid bacteria in the production of curds and cheese and in the acidification of cream requires the presence of certain organic salt compounds in the milk or cream, such as sodium, potassium or calcium compounds, phosphates, citrates, etc. between some of which and the albuminous and saccharine substances of the milk organic interaction occurs. All these substances grouped under the head of organic salt compounds serve as nutritive or buffer substances for the lactic acid bacteria, the yeasts and the mold fungi and ripening bacteria which are so important for the ripening of cheese.

These organic salt compounds are, moreover, equally important for precipitating the casein in the most perfect and proper manner possible and for obtaining the best possible yield of albumin.

The absence of these organic salt compounds has the effect of weakening the curdling tendency of milk and causes milk as well as cream, curds and cheese to become sluggish with respect to acidification and ripening, so that these products are no longer capable of ensuring proper fermentation of the lactic acid bacteria and subsequent ripening. Curdling capacity remain imperfect, the curd formed is too soft and the cheese obtained does not ripen normally, apart from the fact that the yield of casein is insufficient. The daily losses thus incurred in dairying are quite considerable.

The troubles mentioned are due more or less to the spread of intensive cultivation and dairying methods. Owing to the thorough utilization of pastures and arable soil, more mineral salt compounds are withdrawn from the soil than can be replaced by manuring and natural decomposition. Furthermore, milch cows are no longer fed exclusively with hay, grass, grain, turnips, concentrated feed, etc. as in former decades, but as a result of the increasing adoption of intensive cultivation sour fodder, as silage, acidified turnip waste, waste potatoes, etc. or fermented fodder like slops and grains is more and more used. In sour or fermented fodder, however, the content of organic salt compounds is either reduced or leached out, so that as a result thereof both the body of the cow and the milk become poor in these substances.

The bad results of inertness as to curdling and acidification are intensified still more by the necessary pasteurization of milk and cream. Some of the organic salt compounds are so sensitive that they are converted into insoluble and inactive compounds during the heating of the milk. These phenomena are generally known.

For many years past it has therefore been attempted to improve the curdling and acidification capacity of such deficient ordinary milk or of heated milk by the subsequent addition of calcium salts, phosphates and citrates in a more or less chemically pure form. It has been found, however, that this is a relatively crude action with respect to the natural organic salt compounds present in milk which does not contain chemically pure calcium chloride, phosphates, citrates or other salts. All these organic salt compounds in the milk form rather a system which is only superficially known thus far and in which also the mutual combination of some of these compounds with the albuminous substances of the milk plays an important part. Nature has built up all these compounds in milk in a much finer way than that followed hitherto by man who simply adds chemically pure salts or salt compounds and believes he has imitated nature.

In order to supplement the natural occurrence of such salt compounds in milk by artificial intervention it is necessary to consider the more finely built up biologico-organic salt compounds prepared by vegetable or animal organisms and found for instance in saps obtained by pressing fresh grasses or leaves, such as cereals, leguminosae, trifolia, spinaciae and lettuces. Such compounds occur also in freshly obtained blood sera. These vegetable juices as well as the corresponding animal fluids disclose a finer biologico-organic composition of the salt content, which is utilized for instance by employing saps and sera in the preparation of nutrient media for bacterial cultures.

The invention desists from adding salt compounds produced in chemically pure form to the milk and is based upon the knowledge, backed by experience, that saps and blood sera are excellently suited for compensating the natural deficiency of biologico-organic salt compounds in milk and supplementing them in a perfectly natural manner. As the higher composition of the salt content of milk is just as little known at present as the higher composition of the salt content of saps and blood sera, a paraphrase of the term "salt content" whose vagueness is felt and admitted cannot be given. The invention does not include the known use of products like rennet enzymes, peptone, vitamins, pectins, acetic acid or alcohol, prepared in pure form from animal fluids or saps, but it covers, however, the

liberation of the saps or animal fluids from ballast material, as cells, vegetable fibers, coloring matter, pectins, fat-albumin, starch, fibrin, etc., and the partial or total removal of excess water content.

The following examples have been found to give satisfactory results:

Example 1

100 kg. of fresh plants of the cereal or leguminosae species or an equal quantity of spinach or salads are gathered before inflorescence, reduced to small pieces and pressed in known manner to obtain the juice. Ballast material is filtered off, and the juice is evaporated to dryness. The final product is a grey-green powder having a salty taste. 100 kg. of plants yield approximately 3 to 10 kg. of powder. 200 to 1,000 grams of this powder are added to 1,000 liters of milk or cream before acidification or curdling with rennet begins.

Example 2

The dried juice obtained according to Example 1 is added in quantities of 1,000 to 2,000 grams to 1,000 kg. of curd or cheese mass. The cheese is subsequently treated and molded in usual manner.

Example 3

Having been previously filtered 100 kg. of blood serum are evaporated to contain about 50% solid matter. This partly evaporated serum is then thoroughly mixed with the evaporated plant juice according to Example 1. In the proportions stated in Examples 1 and 2 the mixture is added to milk, curd or cheese, either before acidification and curdling with rennet begin or, in case of curds and cheese, prior to the beginning of the ripening process.

GEORG FRIEDEL.

Published May 4, 1943 Serial No. 181,966

ALIEN PROPERTY CUSTODIAN

METHOD AND APPARATUS FOR FORMING A BRIGHT METALLIC DEPOSIT ON THE SURFACE OF OBJECTS

Max Tischer, Bor U C Lipy, Czechoslovakia; vested in the Alien Property Custodian

Application filed December 27, 1937

In order to form a bright metallic deposit on the surface of glass or other materials through chemical methods, use is made, in a known manner, of a solution of a metallic salt from which the metal is precipitated in a finely divided state by the addition of a reducing solution, so as to be deposited on the surface of the object to be covered with a bright metallic deposit. The two solutions, that is to say the solution of metallic salt and the reducing solution, are kept separate and they are mixed together only a short time before they are to be used, because reduction, and consequently metal precipitation, take place immediately after this mixing of the two solutions with each other. The objects on which a bright metallic deposit is to be formed are immersed in the mixture of the solutions, or these objects are coated with this mixture of solutions or said mixture is atomized on the objects. In any case, it is clear that only a very small part of the metal present in the mixture of the solutions can be utilized for forming a bright metallic deposit, because the precipitation of the metal starts as soon as the two solutions have been mixed together and then it keeps going on in a continuous manner, being distributed in a uniform fashion throughout the mass of the mixed solutions, and only a small part of the metal thus precipitated can deposit on the object, whereas the remainder deposits on the bottom or on the walls of vessel containing the mixture. When use is made of atomizing devices, there is further produced, in the atomizing nozzles and in the feed conduits leading to said nozzles, an immediate clogging resulting from the depositing of metal, which also takes place therein, so that even after a short period of time it is necessary to proceed to a cleaning by dissolution of the deposited metal by means of acid, which is complicated and is a considerable delay to the operation.

The object of the present invention is to eliminate all these drawbacks, and also to obtain an improved adhesion of the bright metallic deposit on its support, in such manner that the risk of scaling off, a phenomenon which is particular frequent in the case of silver layers, is wholly eliminated.

The essential feature of the method according to the present invention lies in the fact that the solution of metallic salt, necessary for producing the bright metallic deposit on the objects, and the reducing solution are atomized separately but simultaneously and are caused, in this atomized state, to mix together and to act on the object to be coated with the bright metallic deposit. In order to facilitate the reduction of the metal and to obtain better adhesive qualities of the bright metallic deposit, the atomizing of the solutions, which are kept in distinct containers and are fed separately to the atomizing devices, is advantageously effected by means of steam or heated gases.

According to another feature of the present invention, in order further to accelerate the separation of the metal from the atomized mixture and the precipitation on the object to be coated with the bright metallic deposit, and also in order further to improve the adhesive qualities of this deposit, it is advantageous to introduce steam or heated gases, in particular gases having a reducing action, into the atomized mixture that is produced.

In order to carry out the method according to my invention, I preferably make use of an apparatus including two feed conduits, which are located at a small distance from each other, corresponding respectively to the solution of metallic salt and to the reducing solution, these conduits leading to two atomizing nozzles arranged to make an angle with each other. The atomizing nozzles are fed with steam or heated gases, preferably through a common conduit. The orifices of the feed conduits for the two respective solutions which serve to produce the bright metallic deposit can be located so close to each other that the simultaneous atomizing of these two solutions can be obtained by means of a single nozzle opening between said orifices and acting simultaneously on both of these solutions.

Other features of the present invention will result from the following detailed description of three specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a front elevational view of a first embodiment of the invention;

Fig. 2 is a side elevational view corresponding to Fig. 1;

Fig. 3 is a front elevational view of another embodiment of the invention;

Fig. 4 is a side elevational view corresponding to Fig. 3;

Fig. 5 is a side elevational view of another embodiment of the invention.

In the embodiment illustrated by Figs. 1 and 2 the apparatus includes feed conduits 1 and 1′, located at a certain distance from each other and supplying, one the solution of the metallic salt,

and the other the reducing solution (these two solutions being preserved separately) and a nozzle 4, 4′ corresponding to each of these conduits. Steam or heated gas is fed to these nozzles through a common conduit 2, which is divided into two branches 3, 3′, leading respectively to the lateral nozzles 4, 4′ in question. These nozzles 4, 4′ are located at a small distance from the respective outlets of conduits 1, 1′, in such manner that the steam or hot gases issuing from these nozzles, when flowing in front of these outlets of conduits 1, 1′, suck out the solutions respectively fed by these conduits and disperse them in the atomized state in the form of cones. As a consequence of the angle made by the respective directions of nozzles 4, 4′, the two atomization cones intersect each other at a distance from the outlets depending upon the values of said angle, so that the atomized solutions are mixed together. I introduce, into this atomized mixture, the object on which a bright metallic deposit is to be formed. The reduced metal is thus caused to precipitate on this object, in the form of a highly adhesive bright metallic deposit.

The apparatus is further provided with two lateral atomization nozzles 5, 5′, which are also arranged at an angle to each other and which are fed with steam or a heated gas through the common conduit 6. The cones of dispersion of these nozzles 5, 5′ are directed toward the atomized mixture in such manner that their jets mix with those of the coating (silvering) mixture, whereby precipitation of the metal on the object to be coated (silvered) with this metal is accelerated and the adhesion of the deposit to the support is further improved. In particular, this is the case when gases having a reducing action are fed through these supplementary nozzles 5 and 5′.

The embodiment illustrated by Figs. 3 and 4 corresponds to an analogous apparatus, in which, however, the two feed conduits 1 and 1′, through which the metallic salt solution and the reducing solution, respectively, are fed, are arranged in such manner that their outlets are turned toward each other, at a small distance from each other. To these outlets corresponds a single atomizing nozzle 7, which simultaneously produces the atomizing of the two solutions and causes them to mix together.

The additional atomization nozzles 5, 5′, which are still arranged laterally with respect to the atomization cone thus produced, and which are fed with steam or heated gas from conduit 8, serve, as in the apparatus above described, with reference to Figs. 1 and 2, to accelerate the reduction and precipitation of the metal and to improve the adhesive qualities of the bright metallic deposit.

Other changes may be brought in the manner of using the above described apparatus. For instance, the two feed conduits may be fed with the same metallic salt solution in case the reducing agent is carried by the gaseous fluid atomizing jet.

As above described, one of the features of the invention resides in the fact that the liquid solutions are atomized by means of jets of either steam or hot gases. It is obvious that the invention can be realized by atomizing by means of these jets a mixture of the two solutions containing the metallic salt and reducing agent.

The embodiment illustrated by Fig. 5 corresponds to an apparatus in which the metallic salt solution is fed through a feed conduit 9. To the outlet of this conduit is connected another feed conduit 10 through which is fed the reducing solution. 11 is an atomization nozzle through which steam or a hot gas, containing or not containing a reducing medium, is fed to produce the atomization of the liquids onto the surface of the object.

MAX TISCHER.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

M. TISCHER

METHOD OF FORMING A BRIGHT METALLIC DEPOSIT ON THE SURFACE OF OBJECTS

Filed Dec. 27, 1937

Serial No. 181,966

Fig.1

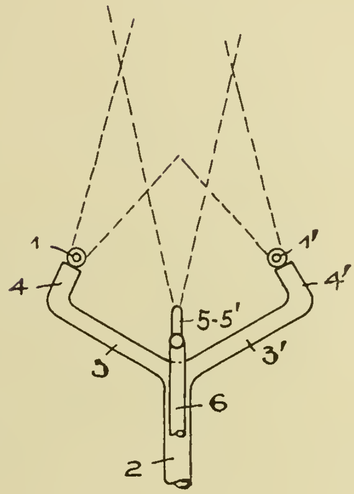


Fig.2

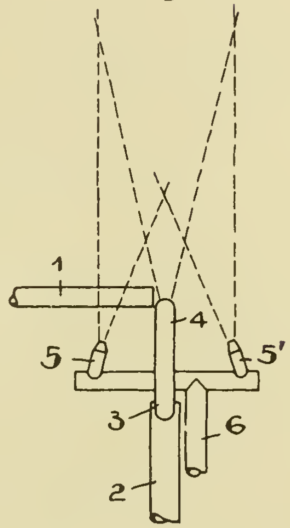


Fig.3

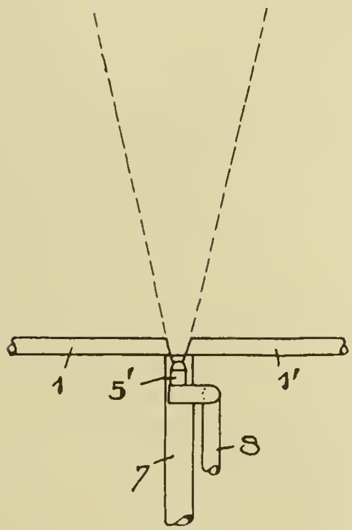


Fig.4

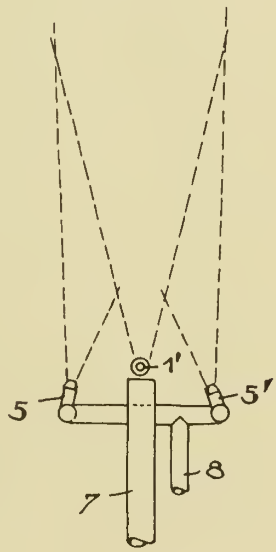
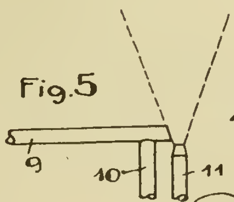


Fig.5



Max Tischer

by

Published May 4, 1943

Serial No. 200,282

ALIEN PROPERTY CUSTODIAN

TOGGLE LEVER PRESS

Adolf Schneider and Ewald Ungethuem, Karlsruhe (Baden), Germany; vested in the Alien Property Custodian

Application filed April 5, 1938

This invention relates to a toggle lever press and to a method of operating such a press.

It is an object of the invention to increase the speed and output of toggle lever presses, to simplify the construction and to reduce the manufacturing cost of such a press.

Another object of the invention is to facilitate the operation of toggle lever presses.

Another object of the invention is to facilitate the ejecting operation.

Still another object is to provide a simple system and method for adjusting the end positions of the ram.

With these and further objects in view, we provide means for effecting the control of the press by hydraulic pressure. More particularly, we control the end positions of the ram, the press table, the ejector and the main shaft by hydraulic pressure.

The invention will be better understood by reference to the following detailed description in connection with the accompanying drawings showing by way of example and diagrammatically an embodiment of our toggle lever press.

Fig. 1 is an elevation, partly in section, viewed in the direction of arrow A in Fig. 2 of a toggle lever press having the invention applied thereto.

Fig. 2 is a side elevation, partly in section, of the press shown in Fig. 1.

Fig. 3 is an elevation of the same press viewed in the direction of the arrow B in Fig. 2.

Fig. 4 is a plan view of the press.

Fig. 5 is a section on line C, D in Fig. 3.

Fig. 6 is a scheme of the control system.

Referring now to the drawings in greater detail, and first to Figs. 1 to 5, the press comprises a main frame 101 in which the press table 22 is mounted for lateral slide motion under action of a hydraulic system 23, 24, 46, as will be hereinafter described. A ram 9 is mounted to slide vertically in suitable guides of the main frame, under action of a toggle lever system 6, 7, 8, 10, in the manner known per se.

The drive of the press will now be described. A pulley 2 fast on a shaft 2' is driven from a motor 1 with pulley 1', by a number of cone belts 3, and in turn drives, through coupling 102, main shaft 33, a slipping clutch 105 and gear wheels 103, 104 and 4, a gear wheel 5 on shaft 45. Mounted on a crank 45' of shaft 45 is a connecting rod 6 acting upon a toggle lever system comprising thrust rods 7 and 8, a stationary support or abutment 10 and a ram 9 upon which the pressure of said system is exerted. The support 10 bears against an adjustable wedge member 11 which in turn bears against the transverse or bridge portion of the main frame 101.

The wedge member 11 is mounted to be movable in a horizontal direction by a thrust rod 12 forming part of a piston 13 movable in a cylinder 14 by hydraulic pressure which is fed and controlled in the manner which will be hereinafter described, so as to control the vertical position of the support 10 which bears against the lower inclined face of said wedge member 11.

The toggle joint support 10 is connected, through two tension rods 15, with a cross bar 16 which can be acted upon by hydraulic pressure in the cylinder 48, through a piston 17 and piston rod 49, thus urging the toggle joint support 10 against the wedge face 11 and locking the wedge member in its adjusted position. The actual position of the adjustable wedge member 11 is shown by an indicator 18 consisting of an index 50 movable on a scale 51 and rotated, through a bevel gear 52 fast on the pointer shaft and a bevel gear 53 fast on the left hand end of shaft 19, from a rack 21 fast on the adjustable wedge member 11 and engaging a toothed wheel 20 fast on the opposite end of shaft 19. In this manner, the lower and upper end positions of the ram 9 are controlled, locked and indicated.

The press table 22 can be horizontally moved by means of a hydraulic piston 23 movable in a cylinder 24 and secured to a thrust rod 118 connected with the plate 25. An ejector rod consisting of an upper part 26 and a lower part 27 extends through the plate 25 and the table 22. Connected to said lower portion 27 is a piston 28 movable in a hydraulic cylinder 117 under control of the pressure of a liquid admitted to either side of the cylinder 52 by ducts and control valves, which will be hereinafter described. In order to ensure that the ejecting operation can take place only when the ejector member 26 is positioned accurately vertically above the member 27, partly toothed rods 29, 30 moved by a toothed wheel 34 on shaft 36, are provided to engage recesses 31 and 32 of the member 27 and the plate 25 respectively when said parts are in the correct positions. The shaft 36 is rotated by depression of the lever 37, pivoted at 38, through a rod 53 and a lever 54. The lever 37 is connected by shaft 38 with a valve controlling rod 39 controlling the press liquid for a hydraulic system 112, 116 (Fig. 6) by which the coupling 102 is operated as will be hereinafter described.

Referring now to Fig. 6, there is shown a diagram of the hydraulic control system. Two gear pumps 106 and 107, driven by an electromotor

108, through a coupling 109, supply oil or water under pressure from a storage tank 110 into the pipe system comprising the control valves, cylinders and pistons, while the excessive quantities of oil are fed back into the storage tank 108, through pipe 111. The elements of the hydraulic pipe system are known per se and need not be described in detail here. Therefore, it will be sufficient to refer to the typical parts of the machine illustrated in the diagram and forming part of the invention.

The main shaft 33 is mounted to be axially movable by means of a piston 112 arranged in a cylinder 116 and controlled by hydraulic pressure through pipes 113 and 114. Thus, when the pressure in pipe 114 exceeds the pressure in pipe 113, the piston 112 and shaft 33 will be moved in right hand direction and shaft 33 will be coupled with the driving shaft 2′, by engagement of the coupling 102 so that the toggle lever system is operated. Again, when the pressure in pipe 113 exceeds the pressure in pipe 114, the piston 112 and shaft 33 will be moved in a left hand direction, releasing the coupling 102, and the flange or collar 33′ on shaft 33 will engage the stationary brake disc 115, so that the press comes to a standstill. It will be understood that it is not necessary for the main shaft 33 to pass through the cylinder 116, but in practice the mechanical connection between piston 112 and shaft 33 or coupling 102 and brake 115 respectively will be established in the manner shown in Fig. 4, by means of a twin arrangement of cylinders 116 operating on shaft 33 by a cross bar 147 engaging a suitable annular groove in the shaft 33 or in a flange 148 on said shaft respectively.

The arrangement of the parts 37 and 39 hereinbefore mentioned with reference to Fig. 1 and controlling the brake and the coupling will now be described in greater detail with reference to Fig. 6. By the lever 37 pivoted at 38 a pinion 37′ engaging a rack portion 39 of a rod 39′ can be rotated, whereby the control pistons 120, 121, 122, 123 on rod 39′ are moved in the casing 126 and open or close the respective channels of the hydraulic control system as will be clear from the drawing, whereby press oil of predetermined pressure is fed to the pipes 114 and 113 for control of the coupling 102 and brake 33′, 115, as hereinbefore described.

The parts of the table control, 22, 25, 118, 23, 24, of the ejector control, 26, 27, 28, 117, and of the controls 11, 12, 13, 14 and 17, 48, 49 for the position of support 10 have been hereinbefore described with reference to Figs. 1 and 2 and will not require further explanation. The manner in which said controls are inserted in the hydraulic control system will be clear from Fig. 6.

Mounted on shaft 45 (Fig. 6) is a cam 119 controlling a rotary piston valve 120 which is connected with press oil pipes 121 (the connection of which with the pressure oil system has been omitted for simplicity's sake), 122 and 123. Thus the supply of press oil to the different control points can be automatically controlled in accordance with the position of the knee lever system operated by shaft 45. The handle 43 which has been described with reference to Fig. 1 operates on a valve arrangement 124 in such a manner that in the position shown in Fig. 6 the wedge member 11 is locked in its position by the support 10 upwardly urged by the piston 17 in the manner hereinbefore described, while in the extreme left and right hand positions of the piston or slide 125 the wedge member 11 is moved in the right or left hand direction respectively, by admission of press oil into the pipes 125 and 126, through the respective outlets of the valve casing 124.

Mounted on the valve casing 124 are piston valves 127 and 128, the pistons 129 and 130 of which are downwardly acted upon by springs 131 and 132 and with the points of their rods 133 and 134 rest on the member 123 acted upon by a spring 138, whereby the piston valves are held open and admit press oil from the valve casing 126 to the pipes 135 and 136 as long as said points engage the upper face of member 123. When the rod 39′ is laterally displaced so that either of the two rods 133, 134 engages the recess 137 or no more engages the upper face of member 123 at all, the respective piston valve will be closed.

Inserted in pipe 136 is a retardation valve 139 and inserted in pipe 140 is a tension valve 141.

The operation of the press is as follows: When the coupling 102 is engaged, in the manner hereinbefore described, the press makes one stroke and, by action of the described control system, the coupling is then automatically released and the brake put on, whereby the press is locked in its upper position.

In this moment the ejector piston 28 is upwardly pressed, under action of the press liquid admitted from said source of hydraulic pressure by said control valves. Now, the press liquid is delivered, by said control valves, into the cylinder 24 and moves the piston 23 together with the plate 25 and the table 22 in which the upper part of the ejector is positioned, in a right hand direction (Fig. 2). The work piece is now removed from the table 22 and another work piece is put on. In the meantime the lower ejector part 27 has been withdrawn to its lowest position, by action of the hydraulic pressure admitted on top of the piston 28 in cylinder 117. Provided on the plate 25 is a stop (not shown) by which a valve is operated in the extreme right hand position of the plate 25 and admits press liquid into the right hand chamber of the cylinder 24, whereby the plate 25 is withdrawn into its operative position. The whole procedure is now repeated and takes place automatically by suitable operation of the control valves for the press liquid which are interconnected in the manner shown in Fig. 6.

Where it is intended to use several tools, for example, one punch each for the first, second and finish-pressing operation, three different punches may be mounted on the tool carriage which can be moved manually for bringing the punches successively into their operative position. After the first and second pressing operation the ejector and press table remain in their normal position while, after the third tool has been operated, a valve is operated by a stop member at the carriage, whereby the press oil is admitted into the cylinder 117 and thereafter into the cylinder 24.

In order to ensure that the tool carriage is in the correct position when the press is operated, a recess 142 is provided in the carriage 40 and a lock member 143 is provided to engage said recess when the carriage is in its working position, thereby releasing the control members 37, 38 for the drive of the machine, through rods 144, 145.

The hand wheel 44 serves to operate a throttle

valve or nozzle through which the press oil flows, whereby the movements of the piston 13 for the stroke adjustment can be accelerated and retarded.

While we have herein shown and described certain preferred embodiments of our invention, we wish it to be understood that we do not confine ourselves to all the precise details herein set forth by way of illustration, as modification and variation may be made without departing from the spirit of the invention or exceeding the scope of the appended claims. More particularly it is within the purview of our invention to operate only a part of the control motions by hydraulic pressure instead of all of them as hereinbefore described.

ADOLF SCHNEIDER.
EWALD UNGETHUEM.

PUBLISHED
MAY 4, 1943.
BY A. P. C.

A. SCHNEIDER ET AL
TOGGLE LEVER PRESS
Filed April 5, 1938

Serial No.
200,282
5 Sheets-Sheet 1

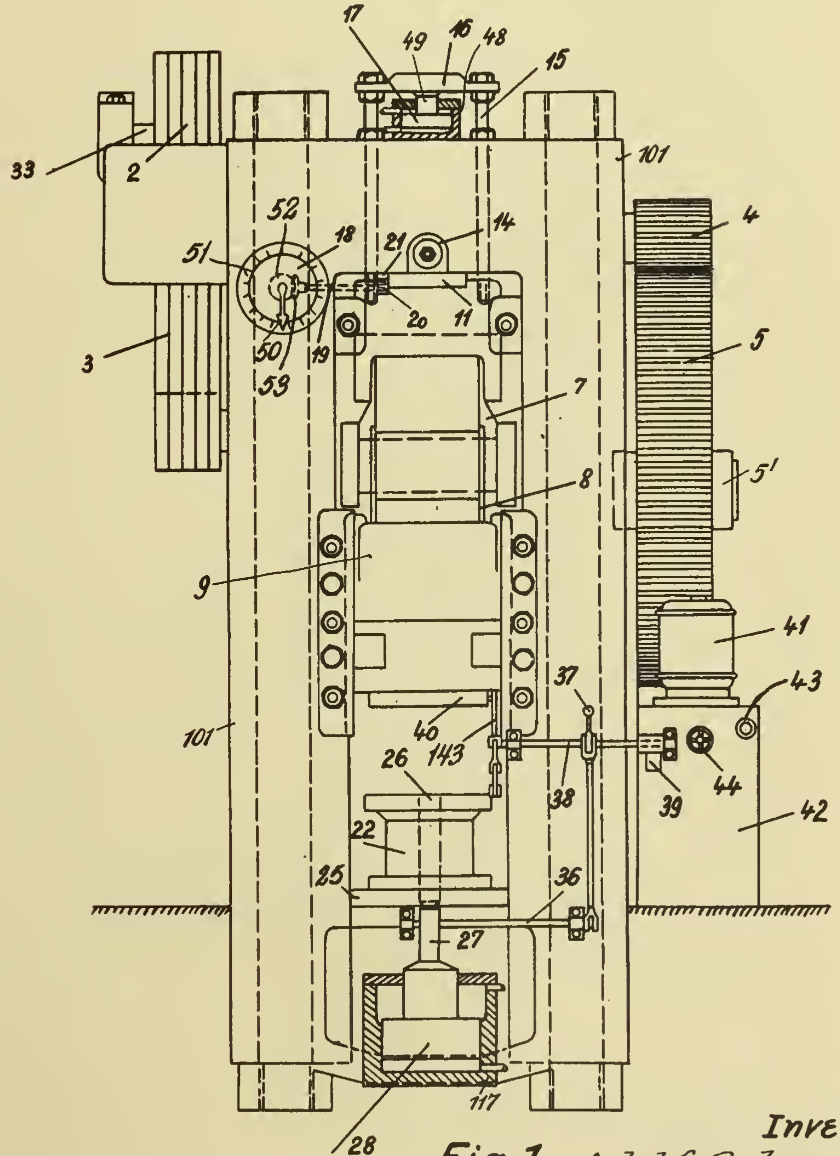


Fig. 1

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by John B. Brady
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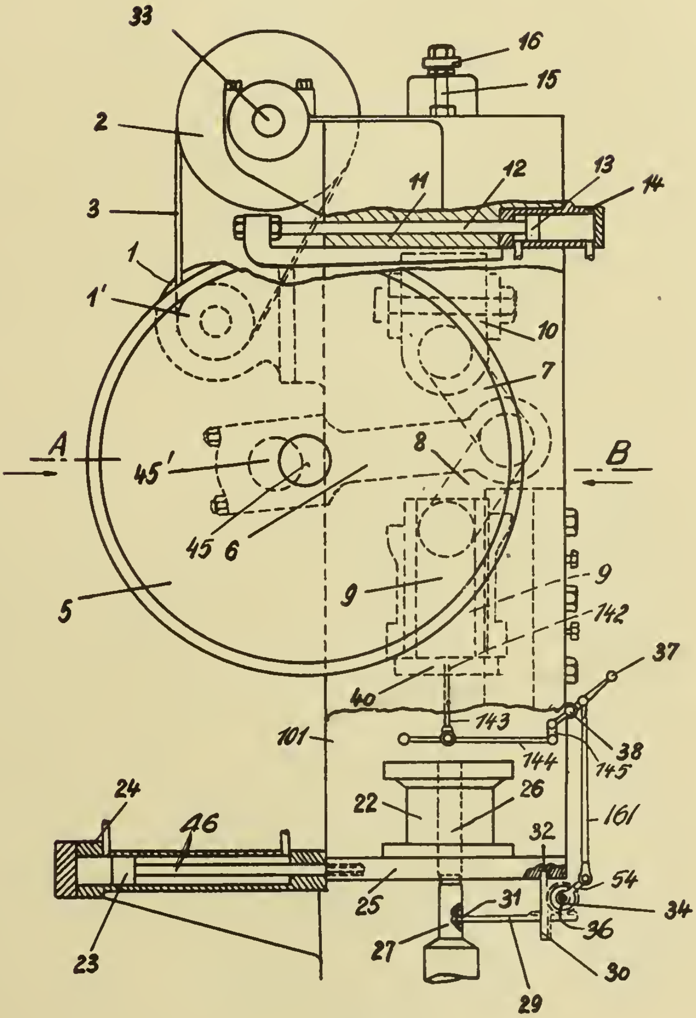

Fig.2

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Fig. 4

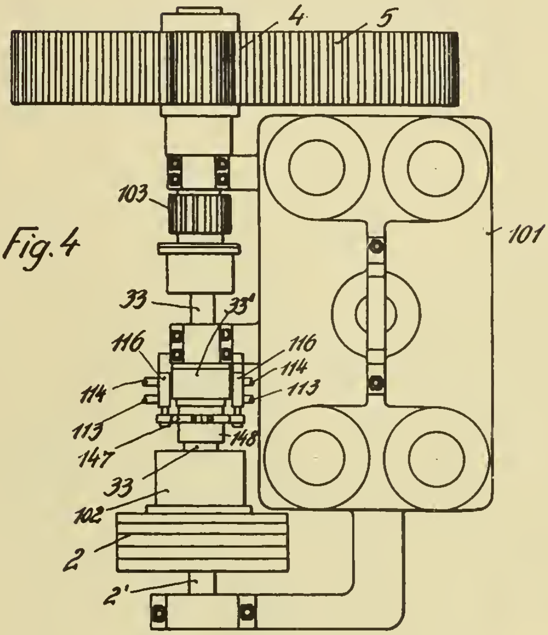

Fig. 5

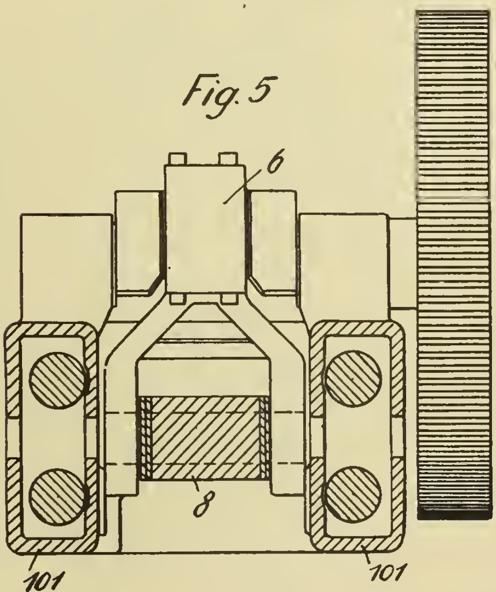

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Fig. 3

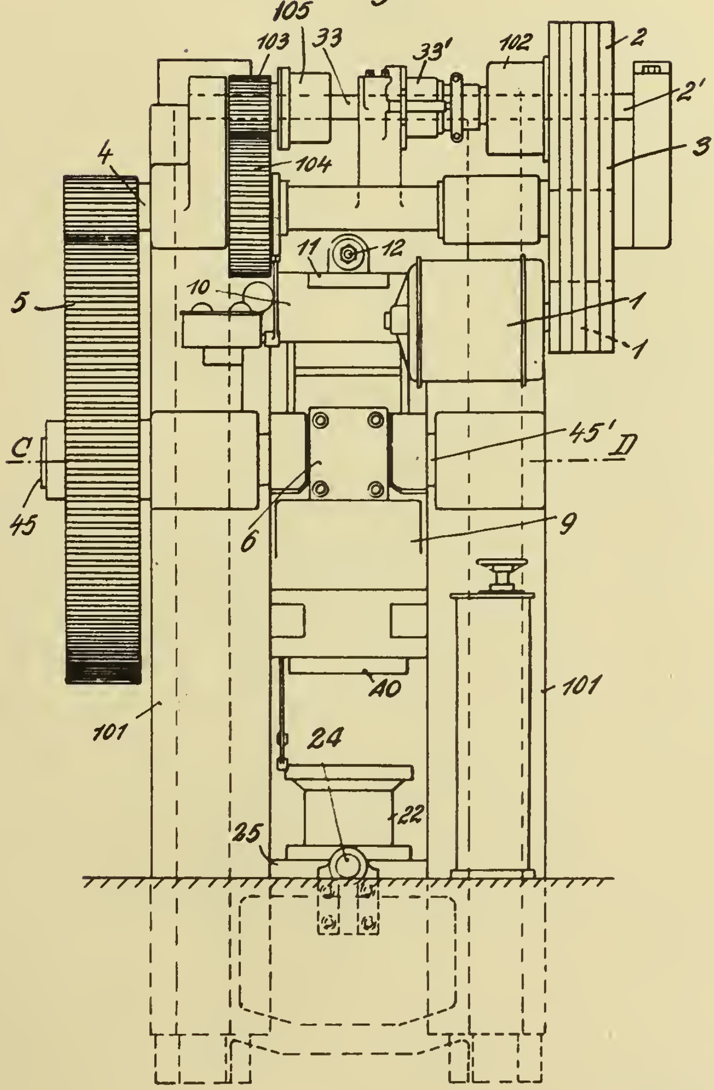

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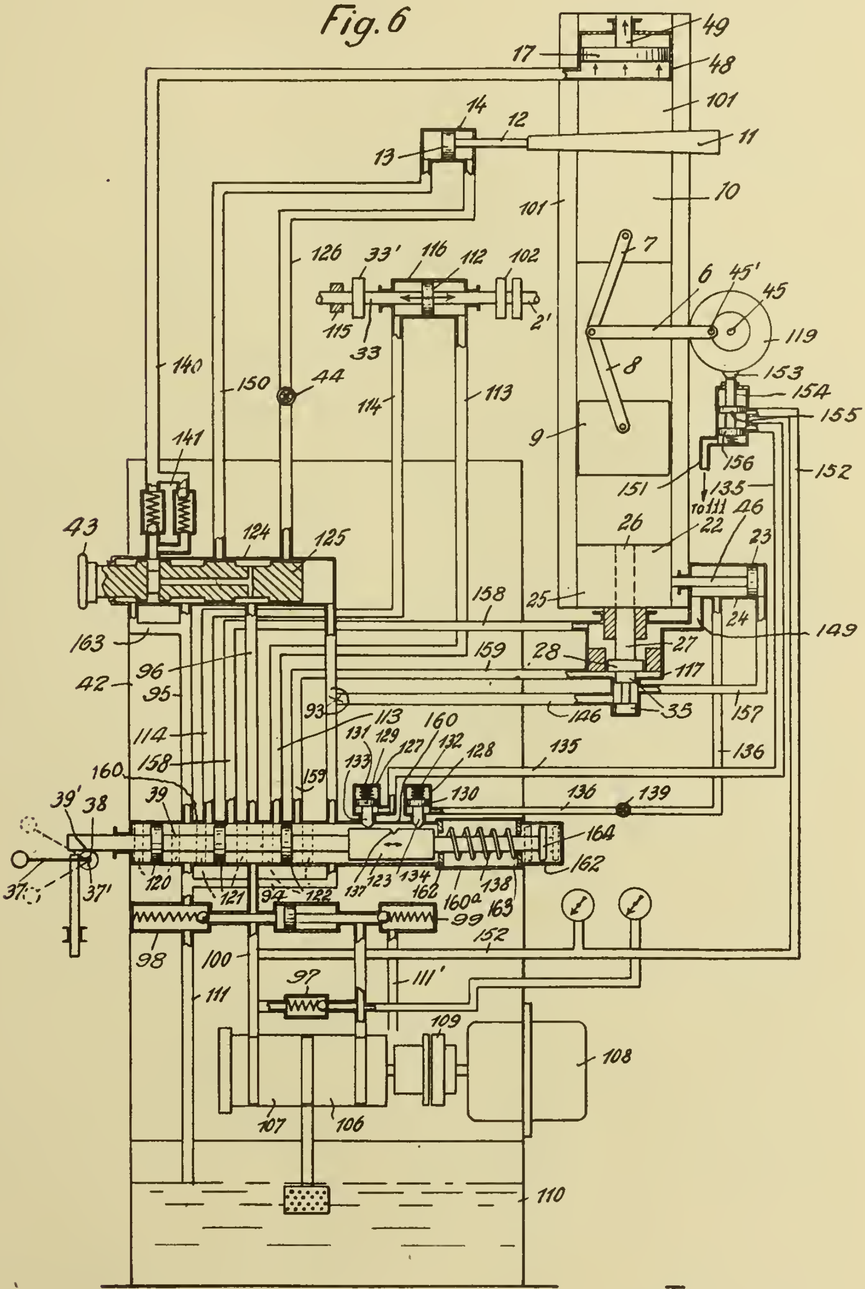
Fig. 6



Inventors
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by John B. Brady
Attorney

Published May 4, 1943

Serial No. 206,083

ALIEN PROPERTY CUSTODIAN

METHOD OF GALVANIZING METAL TUBES, SHEETS AND THE LIKE

Bernhard Ulbricht, Riesa-Groba on the Elbe, Germany; vested in the Alien Property Custodian

Application filed May 4, 1938

This invention relates to a process of galvanizing metallic tubes, sheets and like metal articles in which the parts are first drawn through a lead bath and then through a zinc bath.

The lead-zinc dip galvanizing treatment is ordinarily carried out in a vessel made of material immune to the formation of hard zinc, and in which the molten zinc is floated on and heated by a layer of molten lead. A special separating wall provides that the articles to be galvanized first come in contact only with the lead stratum so as to be thoroughly heated, and thereafter the same are drawn upwardly through the lead stratum into the zinc stratum where galvanizing occurs. On the upper surface of the lead stratum in the area thereof isolated from the zinc by the separating wall there is superposed a fluxing material for removing all impurities from the article to be galvanized.

The ordinary method just referred to is attended with some very serious defects. In the first place the flux above the molten lead is highly heated and gives off extremely disagreeable vapors, which are undesirable for sanitary reasons. Because of loss from vaporization the consumption of the flux is relatively great. The flux also forms a so-called slag which, when tubes are galvanized, prevents perfect galvanization by penetrating into the interior of the tubes. Pipes or tubes, particularly those of small diameter, can even become clogged. Moreover, in the galvanizing stage a very thick zinc coating is obtained on the articles, and the consumption of zinc is undesirably great according to the usual method.

To overcome these defects it is proposed, according to the present invention, to subject the articles to a preliminary separate treatment with a chloride fluxing solution of ammonium chloride and zinc chloride, preferably cold or at least below the vaporizing temperature of the solution, and then immediately thereafter to pass the articles into the molten lead bath, and thence in known manner from the lead bath into the bath of molten zinc floating on the lead.

With the procedure as described there is no occurrence of dangerous fluxing vapors, and the consumption of the fluxing solution is extremely low. Likewise it is found that the consumption of the lead and zinc per ton of production is considerably less than in previously known methods. The formation of hard zinc and ash is also greatly reduced.

The drawing illustrates a form of galvanizing tank used in carrying out the main galvanizing treatment, Figure 1 being a view in longitudinal section, Figure 2 being a transverse section, and Figure 3 being a top plan view.

The article to be galvanized is first drawn through a fluxing solution contained in any suitable vessel (not shown). Immediately thereafter the article is introduced into the galvanizing tank **1** which contains a molten lead layer **2**, an upper molten zinc layer **3**, and a special frame **4** which prevents the penetration of the zinc into the interior thereof. The tank may be constructed of Armco iron or like metal resistive to attack by the zinc. Frame **4** also consists of material which will preclude an undesired hard zinc formation.

The article is introduced through frame **4** into the free surface of the lead as it comes from the fluxing solution, and as indicated by the arrows it is drawn through the lead bath and, after being sufficiently heated, is drawn upwardly into the zinc stratum **3** where galvanization occurs.

BERNHARD ULBRICHT.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

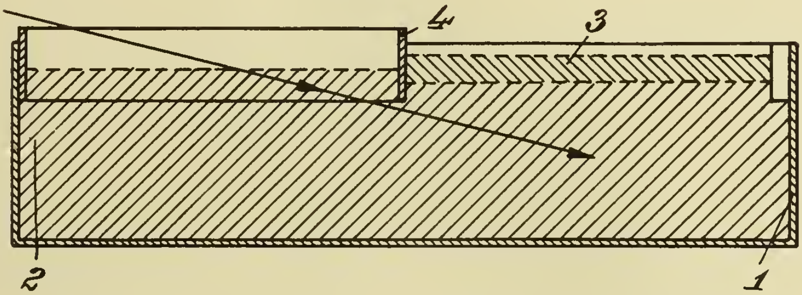
B. ULBRICHT

METHOD OF GALVANIZING METAL TUBES, SHEETS AND THE LIKE

Filed May 4, 1938

Serial No. 206,083

Fig 1.



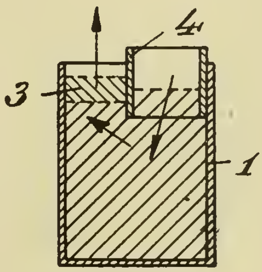


Fig 2.

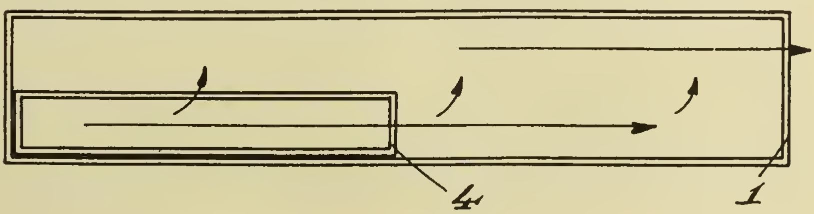


Fig 3.

Inventor:

Bernhard Ulbricht

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Attorney

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[illegible]

PUBLISHED

MAY 4, 1943.

BY A. P. C.

B. ULBRICHT
METHOD OF GALVANIZING METAL TUBES,
SHEETS AND THE LIKE
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Serial No.
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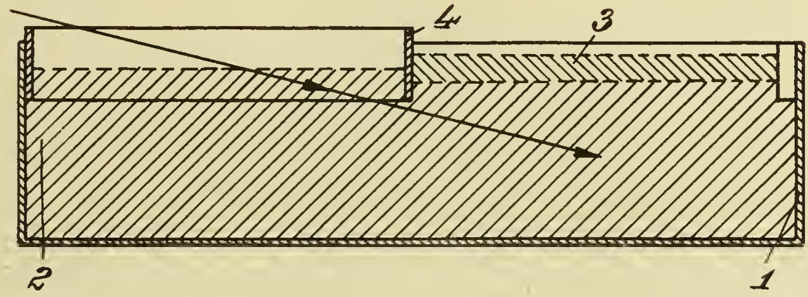
Fig 1.



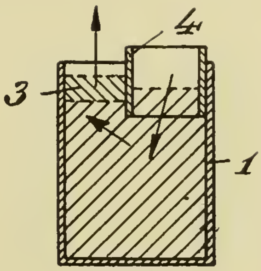


Fig 2.

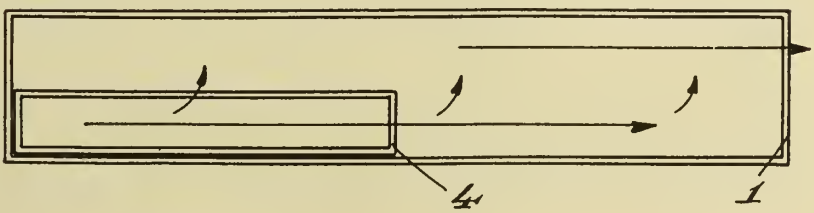


Fig 3.

Inventor:
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Attorney

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Serial No. 213,933

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF STABLE STORABLE RAW FOOD

Alfred Kuhn, Radebeul-Dresden, Germany; vested in the Alien Property Custodian

No Drawing. Application filed June 15, 1938

This invention relates to a process for the production of stable storable raw food, and consists in triturating vegetable foods, such as fruit of all kinds, and also carrots, onions, radishes, spinach, beetroots and the like, in a fresh state with sugars, and without a rise in temperature, and in concentrating the resulting product in the cold.

The process of the present invention enables vegetable raw materials to be converted into a nonperishable product by a cold process, without fear of sacrificing valuable and easily decomposed substances, such as volatile essential oils, vitamins, and the like.

In carrying the process into practical effect the vegetable raw materials are triturated with sugars of all kinds, such as cane sugar, beet sugar, invert sugar, honey, confectionary syrup or the like, at a temperature of the order of room temperature, which can be done, for example, on rolling mills or similar shearing comminuting machines having a shearing action, whereupon the resulting sugar-containing vegetable pulp is dried to the moisture content desired in each particular case, with dry air the temperature of which is likewise of the order of room temperature.

Substances improving the flavour of the products such as malic acid, lactic acid and the like, may be added to the trituration.

After drying, the pulp—which is now stiff—is subjected to a second repeated treatment on the rolling mill, until a jam-like consistency is attained. The stiff consistency of the pulp enables the pulp to be further comminuted until its consistency approaches that of boiled jams.

The preparation produced in accordance with the present invention can be eaten as it is, or be used as a paste for spreading on bread or as a jelly for adding to other foods.

Example I

5 kgs. of carrots are worked up to a fine pulp on the rolling mill, together with a mixture of equal parts of artificial honey and confectionery syrup, 1% of citric acid being added. The resulting mass in spread out in thin layers on metal sheets and rapidly dried in a current of very dry cold air. After water has been removed down to 30%, the mass is passed twice more through the rolling mill to increase its fineness.

Example II

5 kgs. of onions are worked up into a pulp with 5 kgs. of honey on the rolling mill and dried in a current of cold air of great dryness until a water content of 35% is attained.

Example III

5 kgs. of dandelion leaves are worked up to a fine pulp with 5 kgs. of grape sugar and mixed with 2% of a mixture of equal parts of citric and lactic acids. After drying to a water content of 25%, the mass is further fined down on a rolling mill.

ALFRED KUHN.

Published May 4, 1943

Serial No. 216,306

ALIEN PROPERTY CUSTODIAN

MANUFACTURE OF MATERIALS, BOARDS, ARTICLES, OR COMPOSITIONS OF A FIBROUS STOCK

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This invention relates to the manufacture of materials, boards, articles or compositions of a fibrous stock with a resinous composition in which non-acid fatty substances are saponified or emulsified, followed by hardening. The principal aim of the invention is to render the production more simple and cheaper, the resulting products having a greater mechanical strength and being more water repellant than those heretofore known.

The present application is a division of my copending application Serial No. 49,441, filed November 12, 1935.

I have discovered that resin soaps formed by saponifying phenolic resins in an aqueous alkaline solution, such as for instance solutions of KOH and/or NaOH, have the remarkable property of being capable of emulsification with a certain group of fatty substances which can only be dispersed with difficulty in solutions of resins in organic solvents. In the same manner a certain group of fatty substances may be saponified in the said alkaline resin solutions or may be mixed with soaps of such fatty substances. The fatty substances to which I refer are non-acid fatty substances, excluding fatty acids, and including saponifiable fats, oils, and waxes such as stearin, palmitin and castor oil; and unsaponifiable fats and waxes, such as wool fat, paraffin and ceresine. When I speak of "non-acid fatty substances", I mean such substances of fatty character capable of being dispersed or saponified in the aqueous alkaline liquid, so as to produce a homogeneous solution which contains the fatty substances in a finely divided state or in a clear solution and can be diluted with water to any desired extent.

I have further discovered that if base materials, such as wood, sawdust, wood meal, wood felt, sugar cane bagasse, pasteboard, cork meal, leather waste, and the like, are impregnated with aqueous alkaline liquids containing phenolic resins and the above-mentioned fatty substances, materials or articles having a substantially lower water absorbing capacity than those made by impregnation of such base materials with aqueous alkaline resin solutions not containing such fatty substances are obtained. The phenolic resin may also be mixed with soaps of natural resins. In this case the aqueous impregnating liquid consists of phenolic resins, soaps of natural resins and the said oils, fats, waxes, and the like, the latter being in an emulsified or saponified state.

My invention can be applied to materials containing a high percentage of water, without preliminary dehydration, because of the fact that impregnating solutions prepared in accordance with my invention are diluable to any extent with water without precipitation of the resins. For example, wood felt, which generally contains up to 80% of water as a result of the manufacturing process, can be commingled at once with my soap solution, without any intermediate steps.

As soon as the soap solution is incorporated with the base material, drying and hardening can be carried out in drying chambers at temperatures suited to the nature of the base material, preceded, if desired, by molding to give the material the required shape; or, the composition can be molded, dried, and hardened with the simultaneously application of heat and pressure, as described in the following examples.

By impregnating loose fibrous material with an aqueous alkaline solution of phenolic resin containing an addition of certain fatty substances, the resins and fatty substances being precipitated upon the fibrous material by the addition of metallic salts capable of forming insoluble precipitates with the resins and with the fatty substances. The resins and fatty substances being precipitated out of solution upon the fibrous stock, the liquid can then be removed from the mass in a mechanical way, as by draining upon a fine mesh sieve, with, or without suction, or pressure, or both, leaving slabs which can be sufficiently hardened for practical use by heating under such conditions as to harden the resin.

In consequence of the fact that the resin soaps used can be diluted with water to any desired extent, it is possible to make up compositions from pulverulant or fibrous materials with but a slight addition of resin soap, for example, 4% or less, with the advantage that the character of the fibrous stock is retained almost unaltered.

It is also possible, in accordance with my invention, to saponify those fats, oils and waxes which are capable of such reaction in the aqueous alkaline solution of phenolic resin, the substances being precipitated in the form of insoluble precipitates by the addition of the above-mentioned metallic salts.

It is found that the addition of the fatty substances makes the removing of the liquid from the stock quicker and more complete and particularly renders the finished articles more water repellant and consequently less subject to warping and attack by fungi.

The formation of insoluble precipitates of the resins, oils, waxes and fats by the addition of metallic salts capable of forming insoluble precipitates with the resins and with fatty substances

must take place only when the water is removed from the impregnated materials solely by drying without any mechanical operation. But when the water is removed from the impregnated materials by mechanical operations, for instance by sucking, pressing, calendering, centrifuging or the like, the resins and fats which are in a water soluble state as soaps or emulsions must be precipitated by addition of the said salts.

Under the action of vacuum and pressure, wood can be impregnated through its entire cross section with the solutions of the described nature, and then dried or hardened in the usual manner at normal or elevated pressure and temperature. In this manner the wood is not only preserved against decay but also improved, since its water repelling capacity and its strength are increased.

I have further found that textile fabrics can also be improved in quality by incorporating the described additions. After impregnation with the aqueous emulsions or aqueous solutions of soaps followed by precipitating on centrifuging or drying, or both, and calendering, these materials show considerably increased resistance to crumpling, water repellance, and resistance to tearing. Plies of material thus treated can be compressed singly or jointly by subjecting them to the simultaneous or successive action of pressure and heat, to form compositions.

To obtain, or to increase, non-inflammability in the final products, water soluble fireproofing agents, such as phosphates, sulphates, chlorides, bromides, acetates, and the like, as well as water glass, or a mixture of these substances, can be added to the impregnating medium. In the case of molded compositions, the fireproofness is increased by this expedient, while in the case of impregnated materials such as wood in the piece, textile fabric in lengths, and the like, fireproofing is effective without the interposition of separate steps in the manufacturing process. The salts used become deposited on the fiber and are not liable to become washed out.

The impregnated materials can also be treated with an aqueous solution of metallic salts, such as alum-, lead-salts, or the like for the precipitation of water insoluble compounds from the impregnating composition. It is possible by this treatment to produce, for example, loose boards or hard boards from wood pulp or similar material, by removing the water from the impregnated pulp through a fine mesh sieve and hot drying or pressing it. The fatty substances and the metal salts of the same respectively cause a more rapid dewatering of the pulp. The loose and hard boards have low water absorbing capacity, do not mildew and show high bending and tensile strength. If suitable salts, such as water soluble phosphates, borates, sulphates, chlorides, and the like be added to the fibrous material in the course of the described process, the resulting boards are also fire resistant in spite of their loose structure, while at the same time these last mentioned salts are almost proof against washing out.

When I speak of "phenolic resin" I refer to a hardenable synthetic resin which can be produced from phenol, or its polymers, particularly phenol (C_6H_5OH) or cresols ($C_6H_4.CH_3.OH$), and an aldehyde, particularly formaldehyde. Such hardenable resins become insoluble and infusible, when subjected to the action of heat or to the simultaneous action of heat and pressure. Such phenolic resins may be prepared by condensing phenol and the aldehyde in the heat and carrying the condensation to the point of separation of the reacting mixture into two layers. One example of a method for making such a condensation product is as follows:

1000 grams of cresol is mixed with 750 grams of 40% (volumetric) formaldehyde and heated in a reflux condenser. Before commencement of boiling of the mixture 5–10 grams of a condensing agent is added thereto. As condensing agent there can be used, for example, hexamethylenetetramine, soda, oxalic acid, and the like. Condensation can thus be effected either in the presence of alkalies, or in the presence of acids. Boiling of the mixture is then continued until the solution, after becoming turbid, separates into two layers. The condensation product is then dehydrated in vacuo at a temperature up to 90° C, and if necessary reheated at normal pressure until the product in the cold becomes so solid that it is brittle, hard, and similar in appearance to colophony.

For purposes of saponification, this condensation product is pulverized and saponified in the heat, for example, with caustic soda, 480 cc of caustic soda solution of 32° Bé being required for 1 kg of solid condensation product. A 20–30% aqueous start-solution of the said resin is made.

Substances which do not affect the valuable properties of the impregnating composition according to my present invention, may be added to the impregnating liquid.

The hardening process can be accelerated by the addition of various substances, such as alkali bichromate, manganese salts, and the like, which are known as oxidizers.

Examples of the process follow:

(1) 40–60 grams of a hardenable phenol-formaldehyde resin is dissolved in 1 litre of an aqueous solution containing 6–9 grams of NaOH, or 200–300 cc of the said start-solution are diluted with 700–800 cc of water. 15–25 grams of stearin or wool fat are emulsified in this solution suitably in the heat by the use of an emulsifying apparatus or saponified until a homogeneous solution is obtained. 1000 grams of wood meal is steeped in said emulsion, after which approximately 100 grams of ammonium phosphate dissolved in 200–300 cc of water is added to the mass. The resulting composition is dried and molded under a pressure of 285–350 lbs. per square inch at a temperature of 140–170°C.

(2) When asbestos powder is worked up the procedure followed may be the same as in example 1, 1000 grams of powdered asbestos being used instead of 1000 grams of wood meal. In this case the addition of ammonium phosphate can be dispensed with.

(3) 30–40 kg of a hardenable phenol-formaldehyde resin is dissolved in 1000 litres of an aqueous solution containing 4.5–6 kg of NaOH. 30–40 kg of palmitin are then incorporated with the solution (by treating as in example (1) until a homogeneous liquid is obtained). 35 cubic feet of wood in the piece is impregnated with 150–200 litres of said solution, the impregnation being assisted by alternate application of vacuum and pressure of 85–115 lbs/sq. in. The wood is then dried at normal or elevated temperature.

(4) 10–20 grams of a hardenable phenol-formaldehyde resin are dissolved in one litre of a solution containing 1½–3 grams of NaOH or 50–100 cc of the said start-solution are diluted with 900 cc of water. 5–10 grams of wool fat or stearin are then emulsified in the solution suitably in the heat by the use of an emulsifying apparatus or saponified until a homogeneous solu-

tion is obtained. Textiles (linen, cotton or artificial silk) are impregnated with said solution and then drawn through a 4–6% aqueous solution of borax or ammonium phosphate. Surplus solution is drained or centrifuged off and the material is calendered hot.

(5) To aqueous wood pulp 75–100 litres containing 1500 grams of dry wood, there is added 60–90 grams of the solid impregnating composition according to my present invention in the form of an aqueous liquid in the required state of dilution and the mass stirred in order to thoroughly mix the wood pulp with the impregnating composition. There is then added 100–200 cc of a 3% solution of an alum salt and stirring repeated. The mass is then dewatered upon a fine mesh sieve and hot dried to loose boards or pressed to hard boards or other articles by simultaneous application of heat and pressure.

In the above examples phenolic resin may be partly replaced by natural resin and the place of palmitin or stearin can be taken by other saponifiable substances, such as castor oil, or other oils or waxes, such as mining wax in suitable proportions. Instead of the non-saponifiable substance named in the examples there can also be employed paraffin, ceresine, or the like.

There are obtained products which are not substantially hygroscopic, which are readily workable and which are not attacked by insects, such as termites, nor by fungi. In the form of boards, for example, of half inch thickness, these products can be employed for building purposes and in the manufacture of furniture, the boards being used as a foundation for veneers of all kinds and qualities glued on with casein or other glues. One of the valuable properties of the specified soap solutions is that they are very well absorbed by the wood fiber itself, so that, for example, soft wood in the piece can be impregnated right through and then subjected to the hardening or drying process. The resulting product is impervious to moisture, of enhanced mechanical strength, readily workable, and excellently preserved.

It has been found that a fibrous material impregnated with an aqueous solution containing hardenable phenolic resins and non-acid fatty substances emulsified or saponified according to my present invention has a lower water absorption capacity than one containing only the resin compound. Samples of hard board were impregnated with an aqueous, alkaline solution of a hardenable phenol-formaldehyde resin only, without the addition of non-acid fatty substances, while other samples were impregnated under similar conditions with aqueous, alkaline solutions containing hardenable phenol-formaldehyde resin with the addition of increasing quantities of non-acid fatty substances. 6% of the impregnating composition—phenolic resin or phenolic resin+fatty substance—was incorporated in all the tests with the hard board. While the board treated with a solution of phenolic resin only, absorbed 6.0%, 21.7% and 29.8% water, respectively, after the sheets had been left lying in water for 2, 24 and 48 hours, the water absorption of the samples treated under similar conditions with compositions consisting of 90% (5.4% of dry fibres) phenolic resin and 10% (0.6% of dry fibres) wool fat, amounted to 4.6%, 15.7%, and 22.0% only. The expansion in length for these samples was, respectively, 0.064%, 0.379%, 0.411% and 0.061%, 0.317%, 0.347%; while the expansion in width was, respectively, 3.8%, 16.6%, 23.2% and 2.2%, 12.2%, 18.0%.

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FIBROUS MOULDED BODIES

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Moulded bodies and process for their production from fibrous initial substances are extensively known. In one of the processes, the initial material, e. g., wood, is converted by purely mechanical means, while retaining therein the substances such for example as lignine, etc. contained in it in addition to the fibres, into separate very short fibres, whereupon these fibres are pressed with the addition of water or the like if necessary into comparatively hard moulded bodies such for example as sheets.

Such moulded bodies do not, however,—in particular in respect of resistance to breakage—satisfy the requirements placed thereon. Furthermore, the process of production has in particular the drawback that for the production of particularly hard moulded bodies the fibrous substances must be converted for example by grinding the wood in ordinary wood grinding processes into specially short fibres, and the fibrous pulp in this case assumes a glutinous character. With short fibres having a glutinous effect, however, it is known that the indipensable de-watering necessary for further working is accompanied by great difficulties. At least special measures for the de-watering are necessary which however again retard the process of production and by the glutinous constitution of the fibrous pulp the condensing and compression of the fibrous material into a perfect and in particular a hard moulded body is made much more difficult or frequently even made impossible.

To obtain a utilisable fibrous mass for the moulded bodies desired, it has furthermore been proposed to mix very short fibres obtained according to the above-described and purely mecchanical process, with longer fibres.

But there are considerable drawbacks also in the production and working of such mixtures consisting essentially of comparatively fine and comparatively coarse fibrous material. In particular in the production, e. g., grinding of the initial substance from comparatively short fibres, substances of mealy constitution are also produced, which make the desired felting of the fibres difficult, since they rest between the separate fibres adapted for felting and at these places greatly obstruct the close connection together and felting.

The moulded bodies according to the invention are without these drawbacks. The fibrous mass used for the moulded bodies according to the invention is essentially characterised by consisting almost exclusively of bundles of fibres and/or chains of fibrous bundles, which are felted together.

The moulded bodies are made in a simple manner and avoiding the drawbacks of the known processes by the initial material being converted by suitable removal of so-called semi-cellulose consittuents and by mechanical treatment into pliable fibrous bundles and chains of fibrous bundles highly adapted for felting, and these are then pressed in manner known per se.

Among the so-called semi-cellulose constituents which are contained in the initial material in addition to the cellulose, are to be preferably understood resins, pentosanes, pectines and possibly also silicic acid, lignine, and the like. Such substances impart, as is known, for example to the wood its peculiar character according to which it is to be regarded for example as a comparatively hard and rigid fibre carrier.

According to the process of the invention, there can be produced comparatively very hard, dense, strong and if necessary grained moulded bodies such as plates or the like if desired with practically entirely felted fibre bundles and chains of fibre bundles and with specific gravities of about 0.8–1.2. The procedure can be adapted without difficulty in the production process such that moulded bodies are obtained with specially pronounced and suitable grainings and designs.

According to the invention, vegetable materials of all kinds and in particular for example wood, fibre carriers similar to wood, straw and the like, are suitable as initial material for the process.

To produce the moulded bodies, the procedure is for example in particular adopted that solid wood, e. g. waste pieces from saw mills, is first reduced mechanically into for example coarse chips; with straw as the initial material coarse straw chaff is correspondingly produced. The reduced material is then in kown manner passed through a sieve to remove dust and mealy substances, whereupon it is chemically decomposed for example by digesting in a boiler and preferably by the removal of certain quantities of the semi-cellulose constituents, treated to produce good feltability of the fibre bundles and chains of fibre bundles. In this stage of the process, care must be taken that the material is as far as possible not altered externally in form. It is then subjected to mechanical effects, preferably squeezing or beating until the natural structure of the fibre bundles is loosened and afterwards further treated in known manner, e. g., in a refiner and ground while maintaining as far as pos-

sible the fibre chains and fibre bundles, whereupon the fibre bundles and fibre bundle chains coming from the refiner can, if necessary after impregnation with or without the addition of binding or hardening agents and with heating, be pressed to form any desired moulded bodies. With respect to the treatment in the refiner, care must be taken that the defibering of the material in the sense of the invention takes place so that the fibre chains and fibre bundles are in the main retained. If in this stage of the process portions of the fibre bundles are further decomposed so that separate fibres and possibly also fibrous pulp are produced, these decompositions produced beyond the desired fibre bundles can, as has been found, facilitate the further treatment of the fibre bundles or chains of fibre bundles into moulded bodies by forming to a certain extent a cementing substance for the fibre bundles and chains.

One of the most important aims of the process according to the invention is the production of a fibrous material which, on the one hand for example has not the hard natural character of the wood, but has a greater flexibility and feltability and which on the other hand is not decomposed into the smallest individual fibres as is otherwise striven for, for example, for making paper and pulp.

Specially useful and durable moulded bodies have been obtained when care has been taken to obtain completely irregular positioning and felting of the fibre bundles and fibre bundle chains, at least in one direction. In using the moulded body, care is then preferably taken that the said direction of the irregularly located fibre bundles and fibre bundle chains practically coincides with the longitudinal or if necessary the horizontal direction of the moulded body, e. g., the main plane direction of a plate.

In carrying out the production process and in particular in the mechanical subdivision of the initial material into coarse pieces, it is preferably arranged that mealy substances or constituents are not produced.

To attain good feltability or a certain flexibility and softness, first the coarse pieces are treated chemically in such manner that preferably 20–40% of the semi-cellulose constituents referred to above are removed. To this end, the pieces are preferably subjected in known manner and if necessary under pressure to a boiling process in a lye, preferably in a 4–10% soda lye.

With the hitherto known processes, the material boiled in this manner has been subjected directly afterwards to complete disintegration into a fibrous mass, to which end refiners have been used into which the chips have been placed.

Contrary thereto, according to the process the procedure is adopted that the chips after the chemical treatment described are first subjected to a further mechanical treatment until the fibre bundle structure is loosened, pressing, squeezing, beating or the like, being used for the mechanical treatment. The pressing or the like is preferably carried out by means of pairs of rolls. For example, the chips previously treated chemically are carried between rolls under pressures exerted by these of 4–500 kgs. per cm.^{2}, special care being paid to the pieces being subjected practically entirely in the longitudinal direction of the fibre to a beating or partial bursting. In this way a loosening of the fibre chains in the direction of their natural growth is effected. To attain such disintegration of the chips and the like, such devices must be used which, like pairs of rolls, at least do not facilitate the formation of undesired mealy substance.

After the mechanical intermediate treatment outlined, consisting of pressing and the like, a further defibering or disintegration of the chips and the like is carried out in known manner by grinding in refiners, but this only to such an extent that the prior loosening of the wood structure is now followed by a distintegration in the main of fibre bundles and chains. In this there is the important advantage that in particular on account of the treatments which have already taken place of the fibrous material, on the one hand mealy substances are practically not produced and, on the other hand, the refiner after a comparatively short period of working and with comparatively little expenditure of energy gives a fibrous material which according to the aim of the invention consists in the main of fibre bundles and fibre bundle chains.

This fibrous material is then further worked into moulded bodies of the most varied kind and design, and can for example be first placed in a mixing hollander or in a mixing trough in which it is preferably impregnated with substances making it waterproof. When using a hollander, particular care has to be taken that the so-called shearing effect does not occur in the hollander.

After the removal of the fibrous material from the hollander, or the mixing trough, it can if necessary be pressed, after a suitable shaping and under particularly favourable temperatures, with or without binding agents into hard dense and strong moulded bodies. Artificial and natural resins, casein and substances similar to casein, as also drying oils, can be used as binders. In the absence of binders, temperatures of preferably 50–200° C. with corresponding pressures of 3–120 kg. per cm.^{2} are used; in the presence of binders, the temperatures to be used are suitably adapted to the binders.

It is to be particularly noted that the moulded bodies such for example as plates, according to the invention, show an artificial graining specially characteristic on the surface, if necessary particularly influenced by the individual steps of the process and comparable in its irregularity, structure and appearance somewhat to a metal cut, whilst the hitherto known moulded bodies have a uniform structure and surface free from grain comparable to a smooth paper.

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ALIEN PROPERTY CUSTODIAN

ELECTRIC FEELER CONTROLS FOR MACHINE TOOLS

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This invention concerns improvements in or relating to electric feeler controls for machine tools. The tool is moved in dependence upon the movements effected by a feeler which passes over a pattern, so that an exact duplicate of the pattern is obtained.

If the feeler control is mounted subsequently upon an existing milling machine, the milling cutter is fixed in the usual way in the milling machine spindle and the guide sleeve is firmly clamped in the milling spindle head, so that the cutter assumes a fixed position, thus not being movable in the direction of the spindle axis. The feeler device is connected rigidly to the head-piece and thus also to the milling cutter, by means of a connecting arm.

The feed of the feeler occurs in the direction of the spindle axis. This control is effected by means of spindles, bevel wheels, worm and worm wheels. The guide feed is retained in the normal manner, but a friction coupling and a locking brake are provided which, influenced by an oscillating switch, come into operation at a given moment and lock the longitudinal feed. Both movements, control in height and longitudinal feed, are separately derived each from an electric motor.

In the machining process, there are two feeds, namely, the feeler feed and the pilot or guide feed. The feeler feed is effected in a direction to and from the object to be machined, whilst the guide feed moves longitudinally with respect to the object. The guide feed therefore moves at right angles to the feeler feed.

With larger types of machines, the feeler feed movement is preferably located in the milling cutter spindle carriages.

According to the invention, there is provided an electric feeler control for machine tools, in which there is a two-position feeler for controlling the feeler feed and an indirect control of a guide feed in dependence upon the control movement effected by the feeler, the guide feed movement being controlled in dependence upon the extent of the path traversed by the feeler.

Many closely adjacent points are felt off and this closeness is adjustable by an oscillating switch and is dependent upon the choice of the speed of feed.

The movements of the feeler are as follows:

(1) towards the pattern,

(2) after contact with the pattern, away therefrom,

(3) after leaving the pattern, again towards it.

By means of this feeler which represents a double position switch, the control current circuits are so influenced that a spot-shaped and exact feeling off is possible. The feeler responds to movement in all directions.

Conditions for the machine which is to be provided with this control are: a reversal which permits placing the table in reciprocating movement and which permits an adjustment of the stroke of the table, furthermore a subsidiary movement which occurs by a definite amount with respect to the transverse movement after each stroke of the table.

The contour milling is effected by two round tables which are fixed to an angle iron at right angles to the table and are mounted on the working table and are driven in the same way be a sliding shaft which is in connection with the locking brake and friction coupling. An angle gearing for clamping on to the milling cutter spindle guide sleeve permits the milling cutter to function in the horizontal position and so to permit the contour milling.

The arrangement according to the present invention is particularly suitable for machining dies for drop presses and for the plastics industry or the like, and for the contour milling of cam discs corresponding to sheet metal templates.

The feeler is conveyed line by line over the surface of the pattern, or respectively the tool over the work. At the end of each cut, a lateral forward movement or feed occurs equal to the width of a cut. The cutting movement takes place in the vertical direction and the stepwise feed forward in the horizontal direction.

In order that the present invention may be clearly understood an example of the general design, construction and manner of operation will be described with reference to the accompanying drawings, in which:

Fig. 1 is a front elevation of a machine tool;

Fig. 2 is a side view of the machine shown in Fig. 1;

Fig. 3 is a sectional plan view showing the control with reversing gear and the transmission of the control movement to the lifting shaft;

Fig. 4 is a sectional plan view showing the introduction of the control movement by the lifting shaft up to the bracket spindle and the oscillating switch arrangement;

Fig. 5 shows the oscillation switch;

Fig. 6 is a sectional view of the drive and locking of the longitudinal feed;

Fig. 7 shows the locking brake with brake magnet;

Fig. 8 is a view in section of the driving mechanism parts for the movement of the table;

Fig. 9 shows the device for contour milling from sheet metal templates;

Fig. 9*a* is a sketch of the contour milling without the round table;

Fig. 10 shows the drive of the round table;

Fig. 11 is a sectional drawing of the feeler;

Fig. 12 shows the circuit diagram for three-phase current operation with a reversing motor;

Fig. 13 is the circuit diagram for three-phase current operation with reversing gear;

Fig. 14 shows the rough machined article; and

Fig. 15 shows the article during the finishing process.

The machine itself is a normal milling machine (Figs. 1 and 2) and consists, inter alia, of a pedestal **1** and a headpiece **2**. On the headpiece **2** is mounted a motor carrier **3** which supports a milling motor **4**. This milling motor **4** drives a milling spindle **7** by means of V-belts **5** and a stepped pulley **6**. The machine is also provided with an angle bracket **8**, a cross slide **9**, a working table **10**, on which the work A is clamped, and a pattern table **11** which supports the pattern B.

Movement of the angle bracket **8** is electrically controlled in a vertical direction. When the working table **10** effects an upward and downward movement, a contact **73** shown in Fig. 11 is opened and closed, this contact controlling the vertical movement and also the longitudinal feed. By reason of this operating principle a feeler **66**, described in more detail below, associated with the contact **73** moves to and fro relatively to the pattern so that the current circuit of the contact **73** is closed when the feeler touches the pattern B and is opened again during the return movement and so on. By means of this opening and closing of the current circuit, there is controlled through an auxiliary relay **76** (Figs. 12 and 13) a reversing relay **77** which influences a reversing motor **12** (Figs. 1, 2 and 12) in such a manner that clockwise or anti-clockwise rotation thereof is suddenly initiated.

In order to protect the motor **12** from excessive heating, a protective resistance **78** (Figs. 12 and 13) is provided in each phase. The reversing movement is transmitted from the motor **12** through a coupling **13** (Fig. 1) onto a lower worm gear **14**, which is supported in a lower oscillating housing **15** (Figs. 1, 2 and 3). A rising shaft **16** transmits the movement into an upper worm gear **17** (Figs. 1, 2 and 4) which is located in an upper oscillating housing **18**. By means of two bevel wheels **19**, the movement is then transmitted to a bracket spindle **20** which engages with a bracket spindle nut **21**. In this manner, the upward and downward movement of the angle bracket **8** is attained.

In order that the angle bracket **8** may also be moved manually, a bevel wheel shaft **22** (Fig. 4) is provided with a handwheel **23**. In the upper oscillating housing **18** a coupling **24** is mounted which permits the automatic vertical movement to be cut out and allows the bracket **8** to be shifted manually.

In parallel to the current circuit which influences the reversing motor **12**, an oscillating switch **40—44** (Figs. 4 and 5) is actuated which controls the current circuit of a locking magnet **25** (Figs. 6 and 7) which is required for locking the longitudinal feed. The drive for the longitudinal feed is effected from a motor **26** (Figs. 2 and 6) which is coupled through a multiple groove V-belt pulley **27** to a stepped pulley **28** which drives a worm gear **29** located in a worm bearing housing **30**. The movement is transmitted to a clutch coupling **31** (Fig. 6), which by means of a nut **32** and a spring **33** can be adjusted to a particular torque. A ratchet wheel **34** having straight rectangular teeth is keyed to the clutch core **31**, so that locking can occur in both directions of rotation since the reversal of the working table **10** is effected by the motor **26**.

The reversal is effected electrically. Stop cams **35** (Figs. 1, 2 and 12) which are fixed on the working table **10** press against push knobs **36** of a push button switch **37** which is screwed onto the cross slide **9**. In this way a reversing relay **79** (Figs. 12 and 13) is influenced and the motor **26** is correspondingly reversed in polarity and thus changes its direction of rotation.

A locking lever **38** (Figs. 7, 12 and 13) in the form of a double-armed lever is set in operation after the locking, by a magnet **25**. If the magnet **25** is de-energized, the locking lever **38** is drawn back by a spring **39** and the longitudinal feed again comes into operation. The oscillating switch **40—43** is driven from the bracket spindle **20** by means of the bevel wheels **19** and shaft **22**. As long as the feeler touches a level surface, the oscillating switch lever **40** which is carried along by a driver cone **41** (Figs. 4 and 5), the spring **42** and nut **43**, oscillates only between two contacts **44** and **45** without touching them. Even, however, in machining a level surface, the contact systems **44** and **45** can be touched, and this in the finishing and for increasing the accuracy. During the backward and forward oscillation, a locking of the longitudinal feed does not occur so that the working table **10** is moved backward and forward on the cross slide **9**.

If the feeler pin **66** comes to a depression of such dimensions that the previous depression movement of the table, which occurs only with a level surface, is exceeded, then the oscillating switch lever **40** strikes against the contact **44** or **45**, closes the current circuit of the locking magnet **25**, so that the lock **34** and **38** comes into operation and stops the longitudinal feed until the feeler pin **66** again abuts underneath.

The table **10** immediately commences the return movement downward and the oscillating switch lever **40** then interrupts the contact **44** or **45** which has just been closed and the locking magnet **25** is de-energized. The return spring **39** (Figs. 7, 12 and 13) unlocks the longitudinal feed and the working table **10** again resumes its movement.

The contact **45** (Figs. 4 and 5) of the oscillating switch **40—43** is firmly fixed on the angle bracket **8**. The other contact **44** is connected to a lever **44*a*** which is supported on a conical bush **46** and can there be moved and firmly clamped by a clamping screw **47**. The reason for this movement will be explained below.

The automatic longitudinal movement is transmitted from a clutch coupling shaft **48** (Figs. 6 and 8) onto a sliding shaft **50** through a ball joint **49** and from the shaft **50** through a bevel gear **51** and two spur-wheels **52** and **53** onto the table spindle **54**. If the working table **10** is to be adjusted in the longitudinal direction manually, it is necessary for the automatic longitudinal feed to be disengaged. This is effected by means of a coupling lever **55** which takes the

spur-wheel **53** and the bevel wheel **57** out of engagement. The table can then be moved manually through a handwheel **56**.

On the bracket **8** there is a terminal switch **58** (Figs. 1, 12 and 13) which is actuated by a cam stop **59** adjustably clamped on the cross slide **9**. This terminal switch **58** serves to attain a limited stroke in the transverse direction and to stop the working table **10** in any desired adjusted width of cut. As can be seen from the circuit diagrams of Figs. 12 and 13, this terminal switch **58** is directly behind the automatic switch **75** in the current circuit so that the terminal switch **58** is in a position to stop the whole machine.

The feeler is constructed as a double position switch and is connected through a rotatable rod **60** and a connecting arm **61** to the headpiece **2** and thus also to the milling cutter **62**. The feeler is adjustable in level with respect to the milling cutter **62** by the milling cutter spindle guide sleeve **63** being movable by means of a toothed wheel. Furthermore, the feeler can oscillate about the rod **60** and can be moved along the connecting arm **61**. An additional fine adjustment of the feeler pin **66** with respect to the milling cutter **62** is possible by the pattern table **11** being finely adjustable by means of a spindle **64** (Fig. 1) with respect to the cross slide **9**.

The feeler consists of a disc **65** (Fig. 11) having a central stud carrying the interchangeable feeler pin **66**, which is screwed thereto. Externally, the disc **65** is ground slightly spherical so that the feeler can easily move over corners. It must, however, fit exactly into the ring **67**. On the flat side, the disc **65** rests on three set screws **68**. The fastening of the feeler is effected through the ring **67**. On the ring **67** and over the disc **65** is placed an elastic plate **69** which is clamped circumferentially by the upper part **70** (of insulating material). The upper part **70** is provided with a bore **71** which broadens out downwardly into a flat extension. The square of the ratio of the diameters (for instance 6 millimetres diameter of the bore at the top and 60 millimetres diameter of the bore at the bottom gives the square of the ratio as $10^2=100$) then gives almost frictionless transmission.

In the hollow space of the upper part **10**, there is located the operating liquid, namely mercury, up to the mark given on Fig. 11. This arrangement works in a similar manner to the known hydraulic ram, which converts a small force into a large force. For with the feeler described, a small movement of the feeler is converted into a large travel of the displaced mercury, so that it can be regarded as a hydraulic travel amplifier. The exact adjustment level is effected by screws **68** which are also adjusted to compensate for large temperature differences.

If a slight pressure is applied to the feeler pin **66** vertically from below, or laterally, then the displacement causes the mercury to rise in the bore **71**. By means of the screw **72**, current is conveyed into the mercury. With the position of the feeler as shown, the auxiliary relay **76** (Figs. 12 and 13) and the reversing relay **77**, are cut out. The pattern B approaches the feeler pin **66** and as soon as contact is made the mercury rises and contacts with the screw **73**. The auxiliary relay **76** and the reversing relay **77** are energized and the motor **12** suddenly changes its direction of rotation. The working table **10** moves away from the milling cutter **62** and the pattern table **11** away from the feeler pin **66**, and the mercury again falls below the tip of the screw **73**. The auxiliary relay **76** and also the reversing relay **77** are again de-energized. The polarity of the motor **12** is thereby reversed and the table **10** again runs upwards towards the feeler pin **66**, the cycle of operations being repeated. The screws **72** and **73** are provided with hard metal tips. On the failure of any intermediate apparatus, on starting the feeler pin **66**, the mercury will rise until the screw **74** makes contact. In this way the quick break release of the protecting switch **75** is set in operation and the entire current supply is cut off. Furthermore, the safety switch is provided with a bimetal release, so that the machine is also stopped on the occurrence of other faults caused for instance by racing of the milling spindle on the normal current being exceeded. The equalization of pressure in the feeler is effected by a bore which is broadened out at the top.

Instead of providing the reversing motor **12**, the reversing gear can be operated by a three-phase motor **12***a* (Fig. 3). The current circuit which in the embodiment with reversing motor controlled the reversing relay **77**, now controls an electromagnet **80** which attracts a reversing coupling **81**.

As soon as the current circuit is interrupted, the magnet **80** is de-energized and the spring **82** predominates and reverses the direction of rotation which the shaft **83** transmits to the lower worm gear **14** and onto the bracket **8**.

The contour milling (Figs. 9 and 10) is rendered possible by the milling tool **62** being brought into the horizontal position by a bevel wheel drive **85**. On the working table **10** there is clamped an angle iron **84** which is provided with two similarly driven round tables **86** and **87**. One round table **86** carries the work, for instance, the cam disc **88** to be milled, and the sheet metal template is laid flat upon the other round table **87**. A feeler suitable for the horizontal position operates on the sheet metal template. The electric vertical movement is maintained in the table movement. The automatic longitudinal movement with the clutch coupling **31—33** and locking device **25, 34** and **38**, functions through two toothed wheels **89** and **90** on a second sliding shaft **91** which drives through two bevel wheels **92** onto the worm shaft **93** of the round tables **86** and **87**.

With larger types of machines, the electric control is located in the transverse movement of the cross slide **9**, and it thus acts on the transverse spindle **95** (Fig. 2), which moves the cross slide, that is, in the horizontal direction. The round tables **86** and **87** are then arranged horizontally on the working table **10** and are also driven by the automatic longitudinal movement with locks **25, 34** and **38** and clutch coupling **31—33**.

A reversing switch **94** is inserted in the current circuit in order that such parts as are actually to be machined on the round table in the contour milling process, can also be copied on the longitudinal table. The work **88** is clamped on the angle iron **84** (Fig. 9*a*). Parallel thereto is fixed the sheet metal template and first of all the upper circumference of the work **88** is felt off to the two points *a*, so that the electric vertical movement of the working table occurs from below upwards.

The reversing switch **94** is then reversed and the lower part of the work **88** is felt off again to the two points *a*, so that the electrical vertical movement now, however, occurs from above downwards. By means of this arrangement, it is not necessary to provide two round tables but all similar articles can be copied in this way.

Finally, the diagrams shown in Figs. 14 and 15 will be explained.

During rough machining (Fig. 14) considerable importance is placed on a great amount of work and small accuracy. This can, in the first place, be attained by the selection of a high speed of feed, and secondly by the adjustment of the oscillating switch **40—43**, in such a manner that the two contacts **44** and **45** are placed widely apart so that the longitudinal feed is not interrupted with the usual vertical control, and the oscillating switch lever **40** only swings backward and forward without touching the contacts **44** and **45**, so that it is immaterial whether the points to be felt off are brought quite close together, since the locking of the table feed commences even before the electric vertical control has terminated. It is thus seen that the accuracy is not dependent upon the contact path and the play of the driving mechanism parts, but only upon the closeness of the points to be felt off. This closeness can be regulated to any desired small value, the accuracy thus being extremely great.

In the two Figs. 14 and 15 the points to be felt off are shown wide apart for clarity in order that the method of working of this described arrangement can be understood. It is assumed that the working table **10** moves from A to B, that is, in the direction of the arrow.

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PUBLISHED

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BY A. P. C.

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ELECTRIC FEELER CONTROLS FOR MACHINE TOOLS

Filed Aug. 3, 1938

Serial No. 222,743

8 Sheets-Sheet 1

Fig. 1

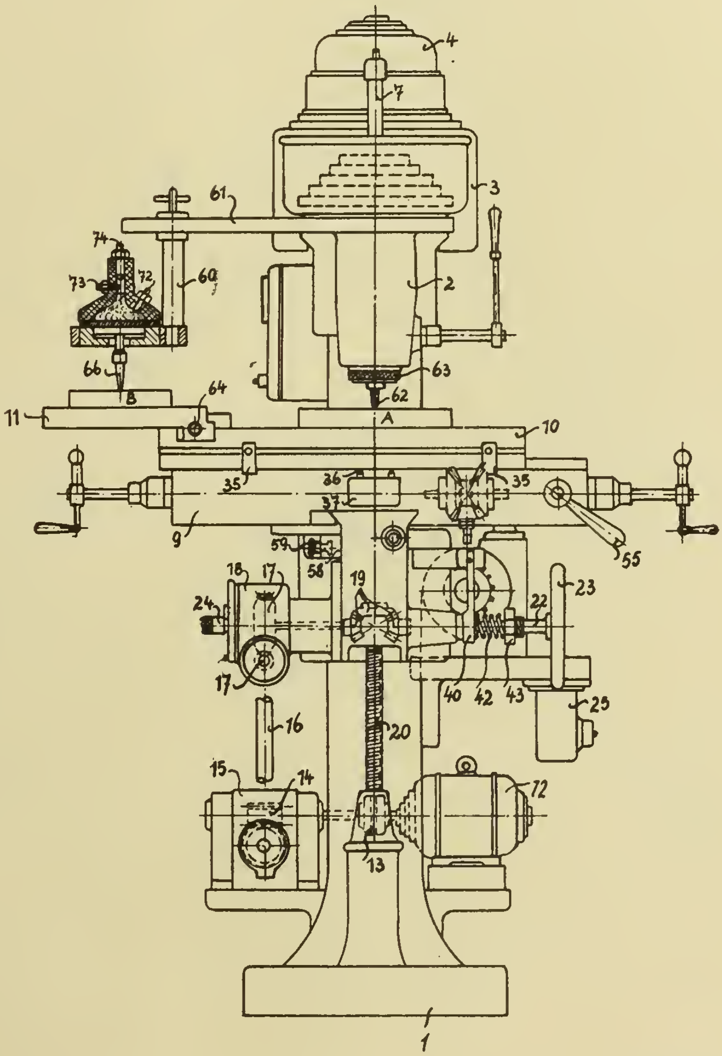

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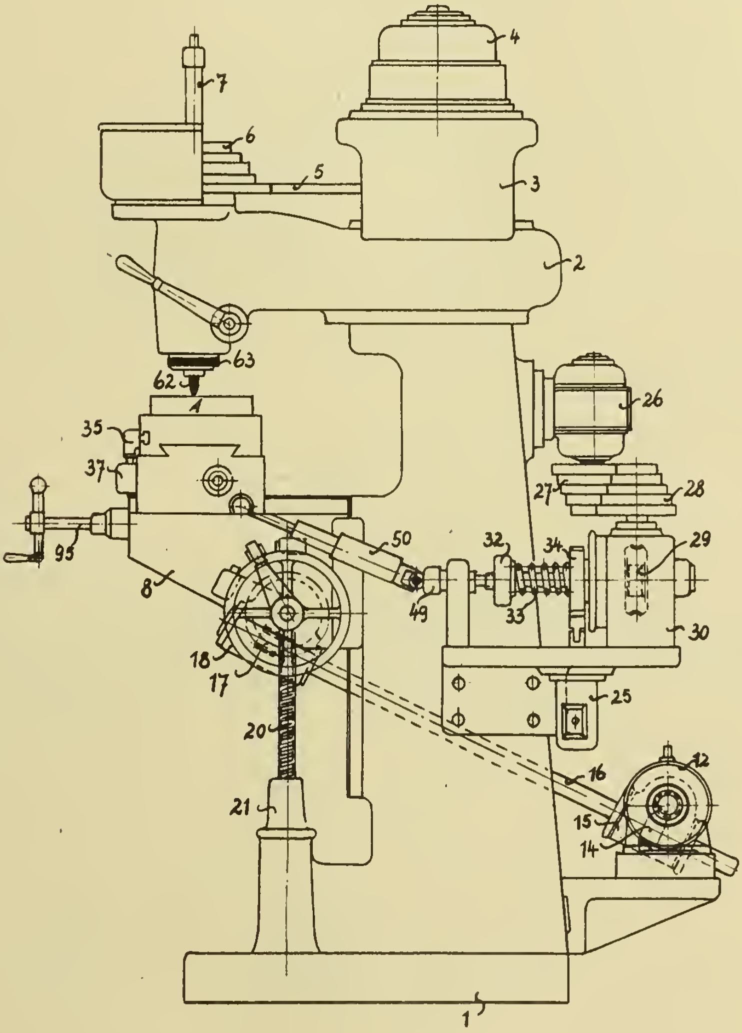
Fig. 2



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8 Sheets-Sheet 3

Fig. 3

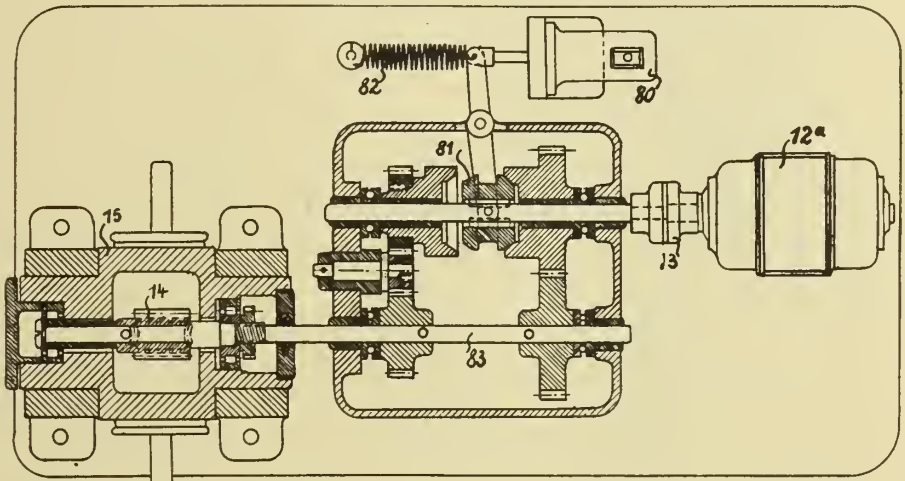
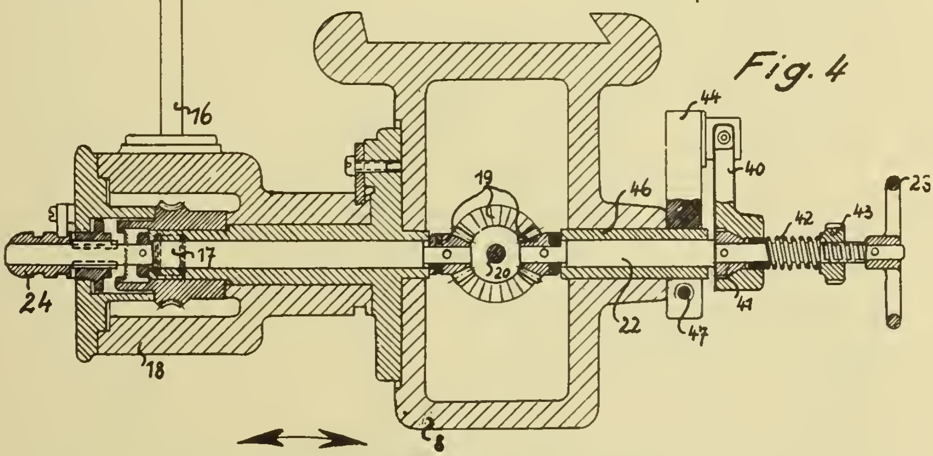


Fig. 4



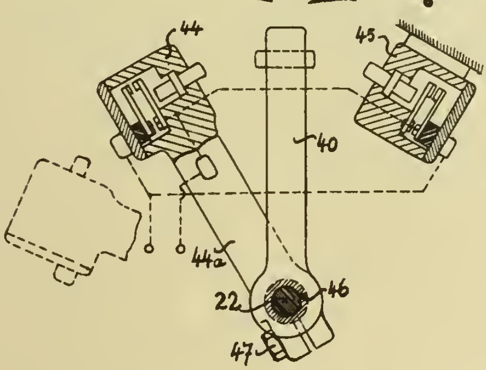


Fig. 5

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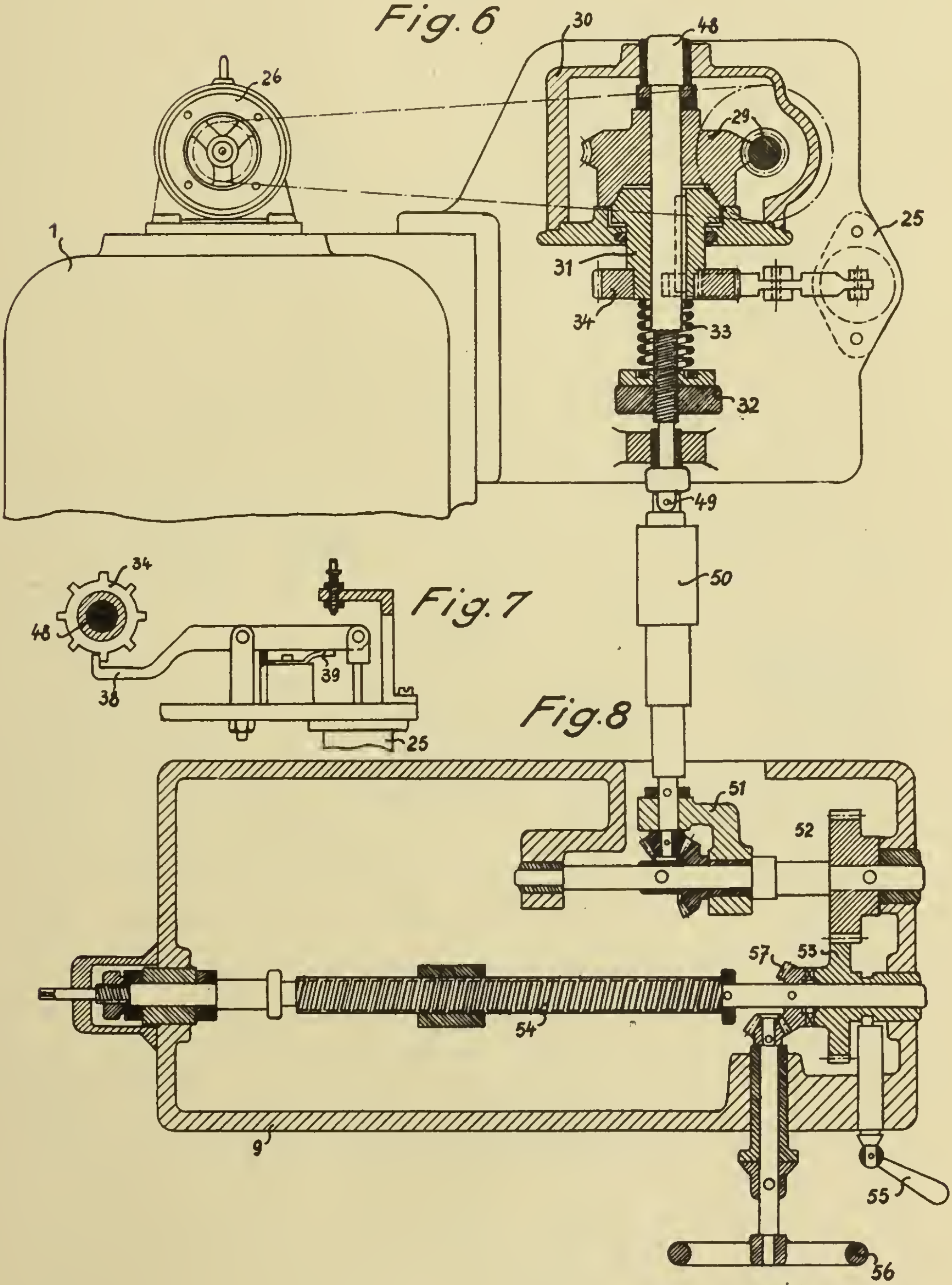

Fig. 6

Fig. 7

Fig. 8

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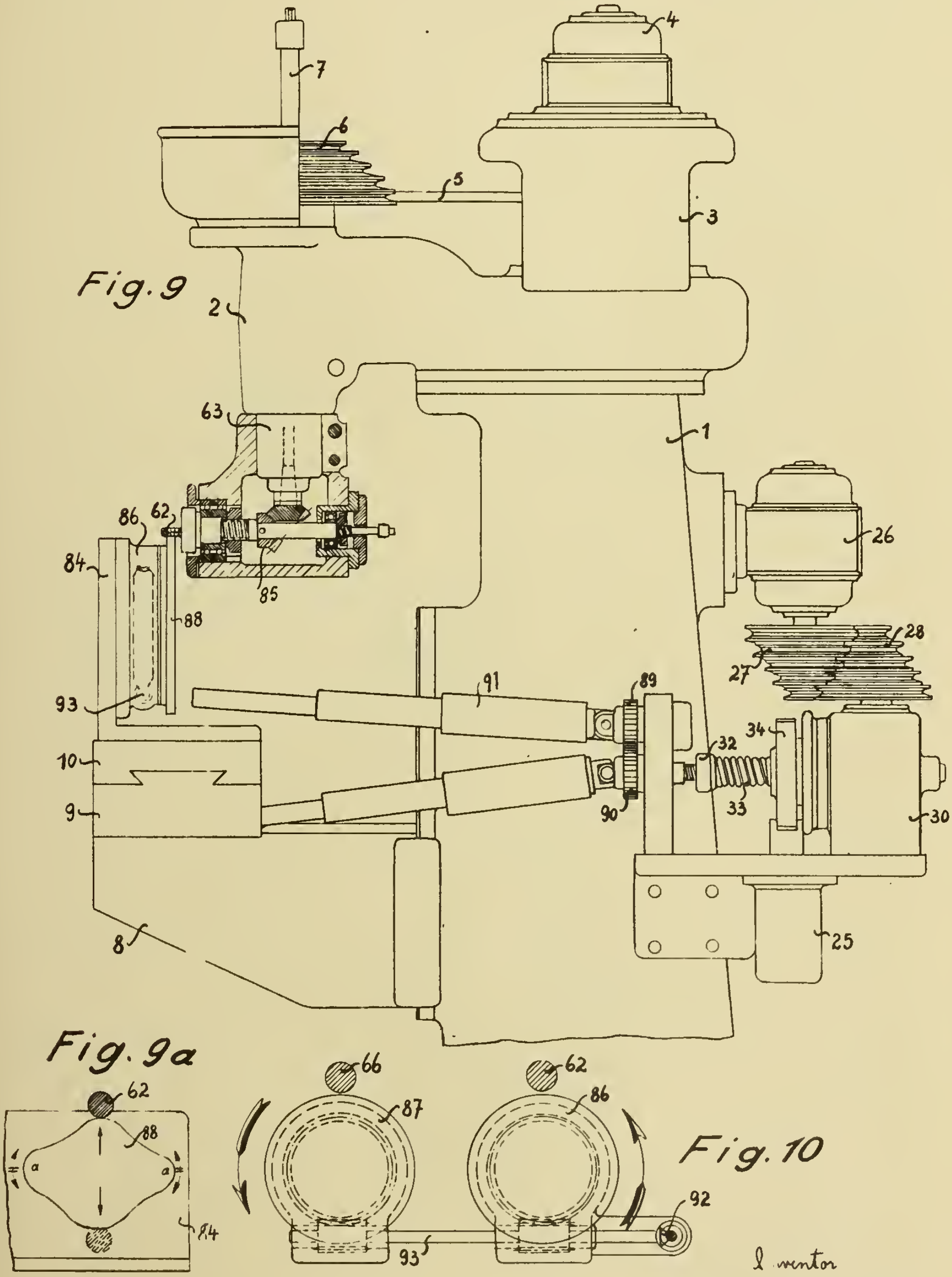

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ELECTRIC FEELER CONTROLS FOR MACHINE TOOLS

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Fig. 14

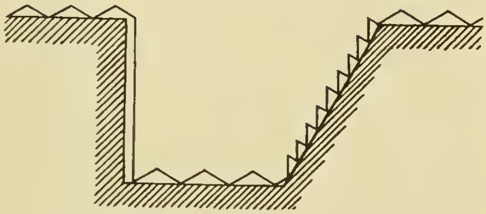

Fig. 11

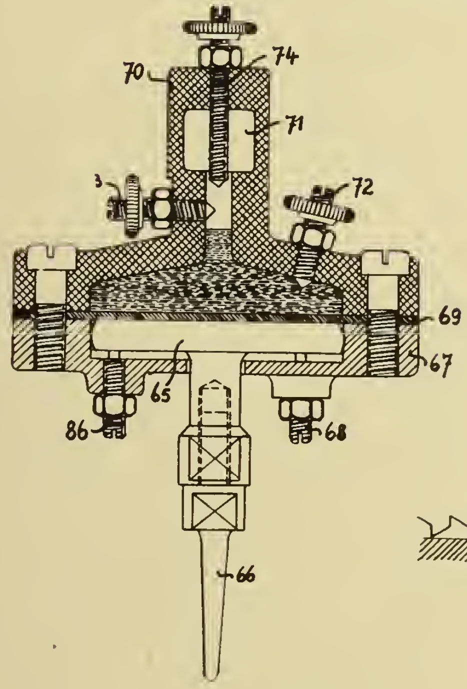

Fig. 15

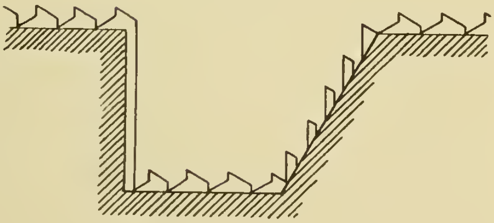

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Fig. 12

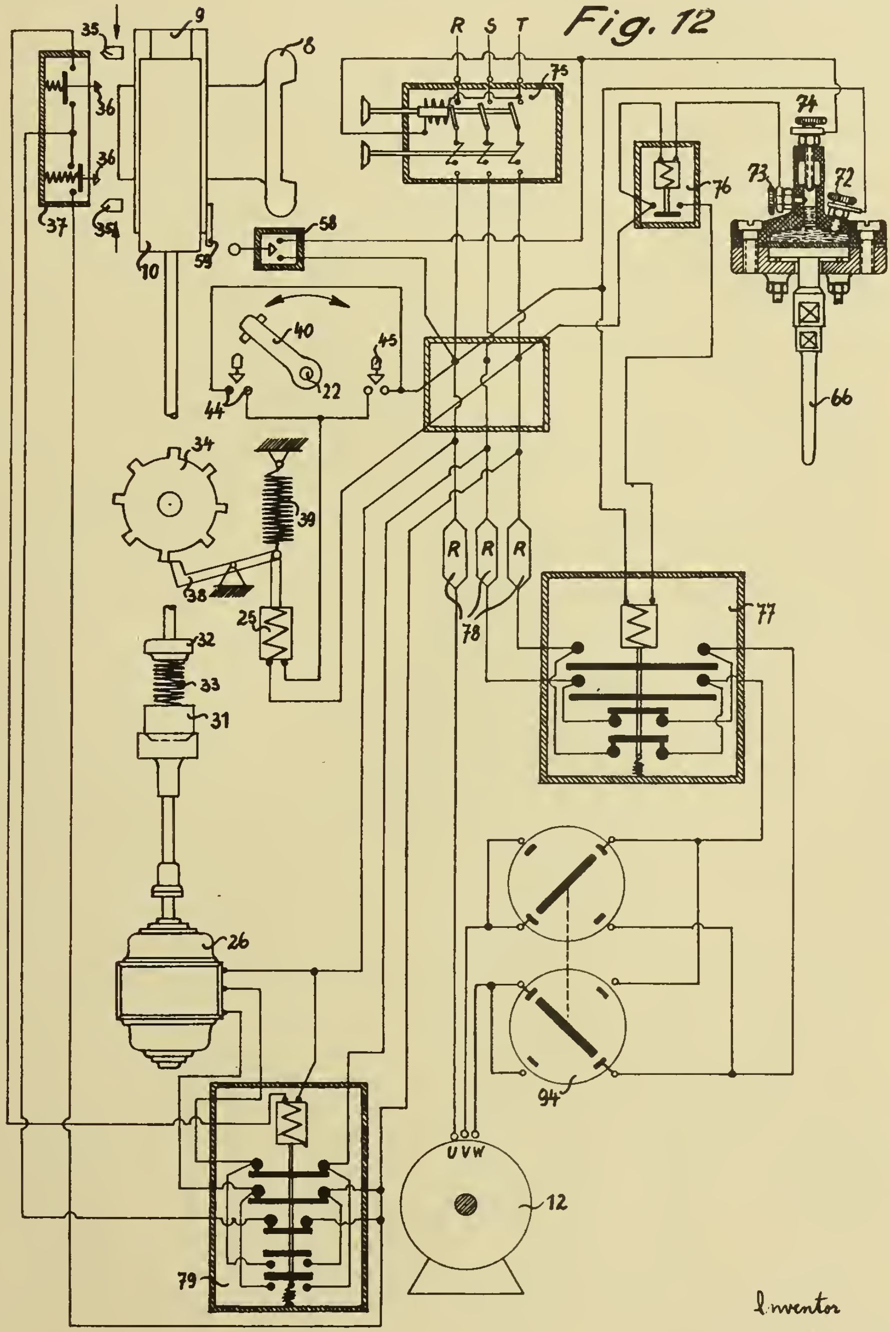

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Fig. 12

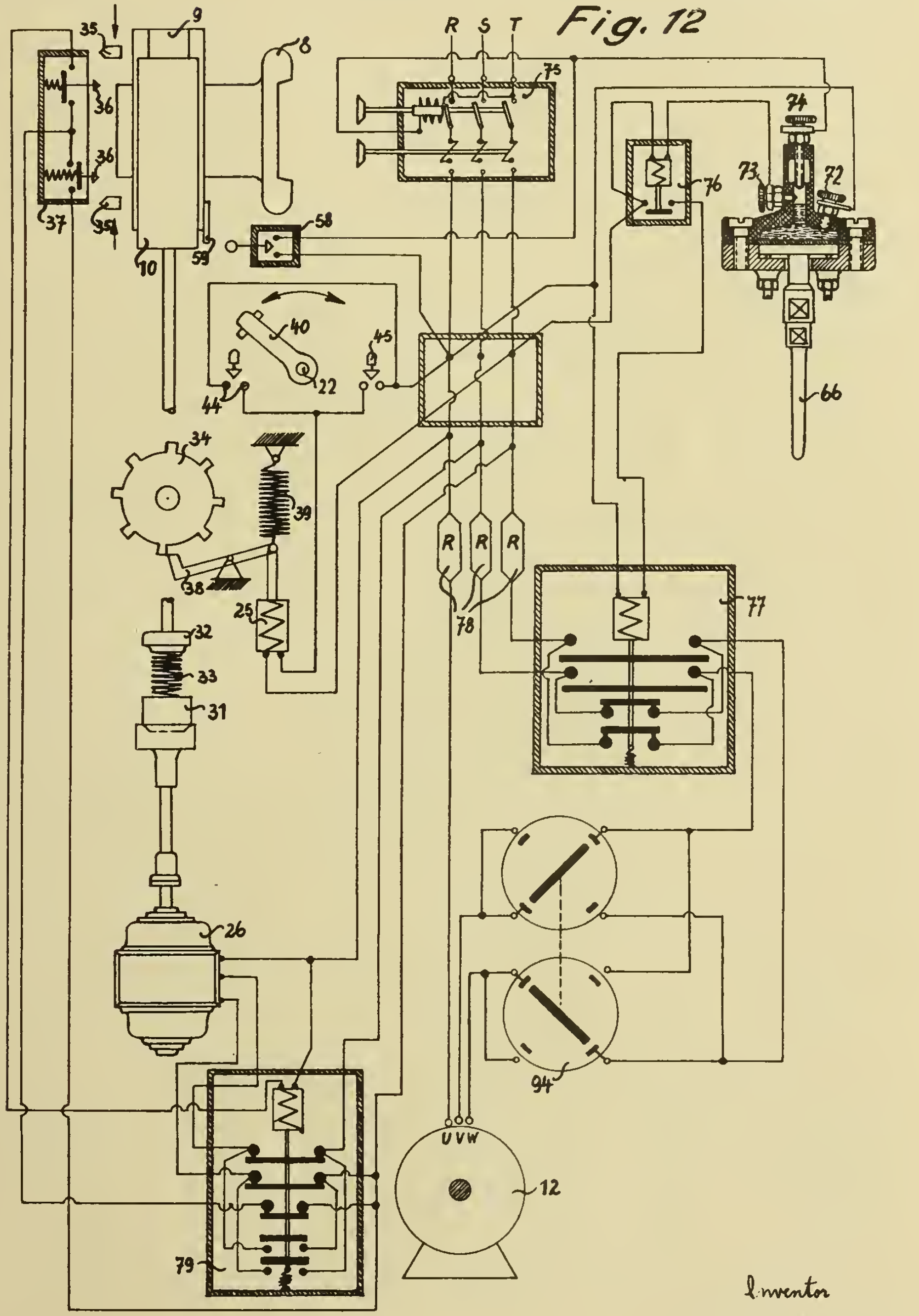

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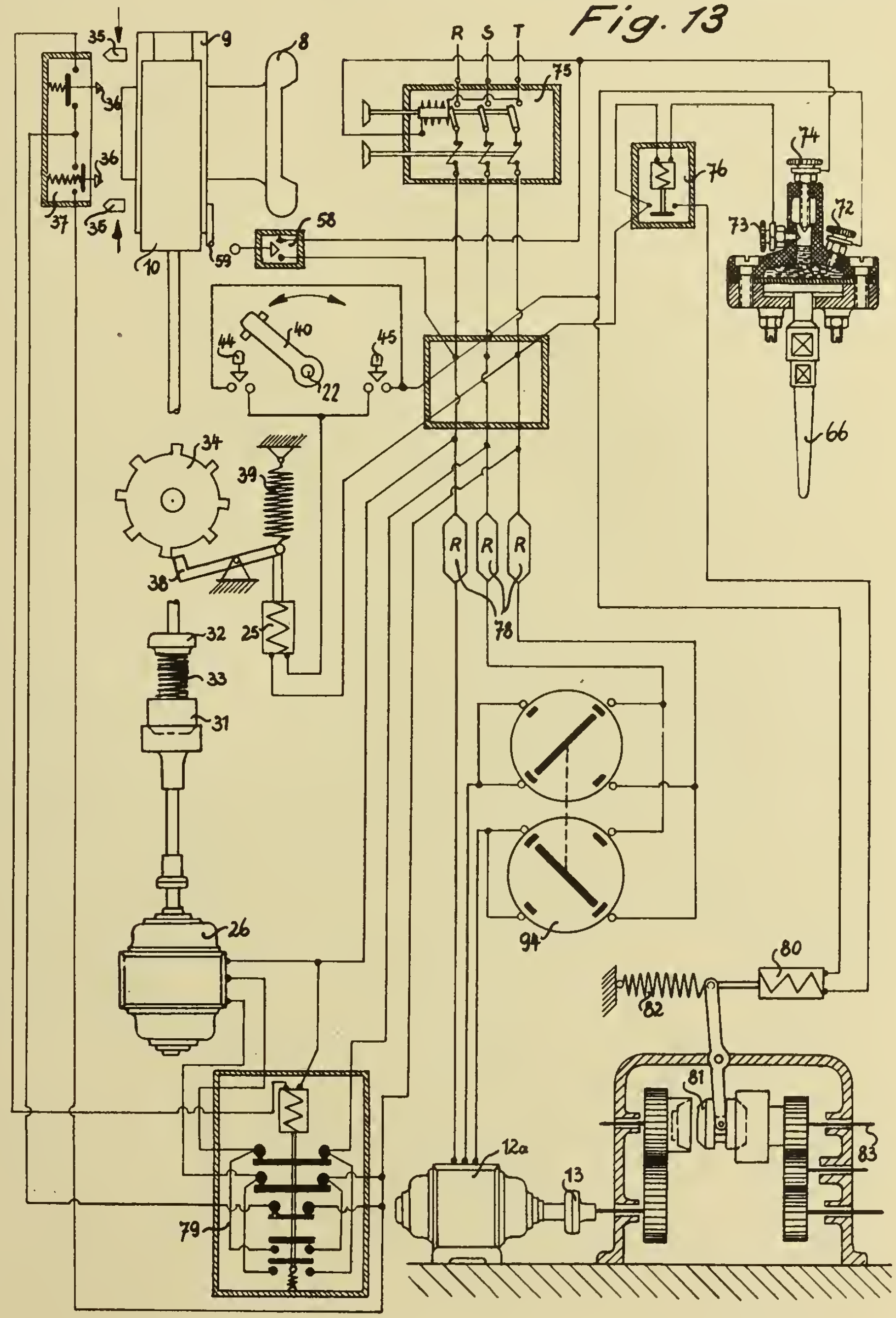
Fig. 13



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ALIEN PROPERTY CUSTODIAN

SINKERS

Max Nebel, Chemnitz, Germany; vested in the Alien Property Custodian

Application filed August 12, 1938

This invention relates to sinkers for flat knitting frames, which possess superposed throats of which the upper one is located in front of the lower one.

Sinkers of this type can serve for various purposes when loops of different length are separately to be formed from several threads, and the invention consists in causing the lower edge of the upper throat to extend rectangularly or almost so relative to the longitudinal axis of the sinker, so that a longer loop formed in the upper throat can slide out of it without resistance.

By way of example, the invention is illustrated in the accompanying drawing which shows four sinkers constructed according to the invention and the needles associated therewith.

Each sinker possesses an upper throat **1** and a lower throat **2**. The upper throat **1** is disposed in front of the lower throat **2**, so that during operation of the sinker in the direction of the needle **3** the upper thread **4** is drawn out into longer loops than the lower threads **5**. The lower edge **1***a* of the upper throat **1** is rectangularly disposed relative to the longitudinal axis x—x of the sinker.

The advantage afforded by the invention is that during motion of the needle in the direction y the withdrawal of the loop caused thereby is effected without encountering any resistance.

MAX NEBEL.

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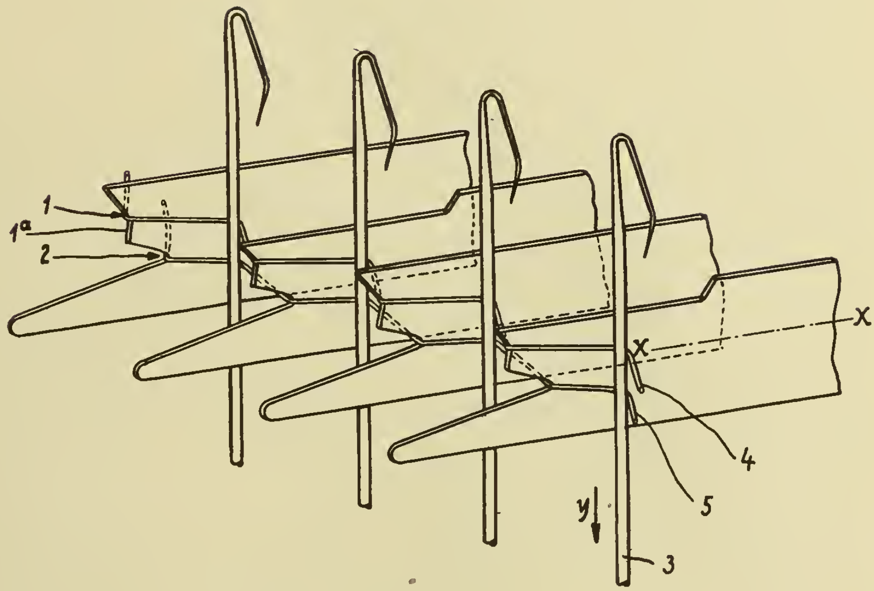

Inventor:
Max Nebel.

Published May 4, 1943 Serial No. 224,546

ALIEN PROPERTY CUSTODIAN

STOCKINGS

Max Nebel, Chemnitz, Germany; vested in the Alien Property Custodian

Application filed August 12, 1938

This invention relates to stockings of all kinds, as worn by both women and men, and has for its object to reinforce the top of the leg and other portions of the stocking by working plush loops into the ground fabric.

Such portions are the part of the leg immediately connecting with the top and the usually spliced portions comprising the high heel, heel, sole and toe, the heel angles and other parts exposed to special stresses. According to the invention, these portions are reinforced in this special manner either separately or in certain combinations or partial combinations to impart to them greater durability, tensile strength, softness and elasticity than is possible by using splicings of the known kind and to secure them against the formation of ladders due to thread breakage.

The invention proposes to provide the portions to be reinforced on the side where the back of the fabric is located with plush loops which represent sinker loops formed of a plush thread which is plated together with the ground thread and whose sinker loop is made longer than the sinker loop formed by the ground thread. These plush loops are preferably disposed above every sinker loop formed by the ground thread and on the rear side of the goods form a fine pile which, compared with regular splicing, i. e. two- or three-threaded plain goods, affords the advantage of increasing tensile strength and elasticity while preventing the formation of ladders in the portions concerned.

Furthermore, stocking portions treated in the manner described are very soft and therefore pleasant to wear, and the plush loops in the top serve also for insuring good gripping of the garters. The fabric is firmly clamped and does not slip out even if tightly held by the garter. Another feature is that reinforcements consisting of plush loops are not noticeable on the right side of the goods.

The stockings concerned are made either on flat knitting frames or circular knitters, though it is also possible to produce certain parts on one machine and others on the other machine.

By way of example, the invention is illustrated in the accompanying drawing, in which Figure 1 is a view of the upper portion of a full-length stocking made on a flat knitting frame and having a single top; Fig. 1*a*, a cross section of the top shown in Fig. 1; Fig. 2, a view of the upper portion of a three-quarter length stocking having a narrow double top and worked on a circular knitter; Fig. 2*a*, a cross section of the double top shown in Fig. 2; Fig. 3, a view of a full-length stocking having a double top and reinforced foot portions and worked on a flat knitting frame; Fig. 3*a*, a cross section of the double top shown in Fig. 3; Fig. 4, a view of a knee-length stocking whose leg and top are made on a flat knitting machine while the reinforced foot portions are produced on a circular knitter; Fig. 5, a cross section of a double top; Fig. 5*a*, a cross section of another double top; Fig. 6, a view of a plush design; and Fig. 7, a view of a colored plush design.

Like reference characters refer to like parts throughout the several views.

Referring to the drawing, the top **1** shown in all the figures may differ in structure. The top **1***a* in Fig. 1 comprises only a single layer, but a top may be formed also by turning over the upper end of the leg and joining the double layer obtained by knitting or sewing. Such a top is shown in Figs. 2 and 3, the juncture in Fig. 3 being designated **1***c*. The rear side of this top may be arranged on the outer or inner side of the stocking, depending on where the plush loops are desired. If in case of the single top **1***a* shown in Fig. 1 the rear side of the fabric is to be arranged where the right or front side of the rest of the leg is located, the top must be united with the leg by seaming or transferring during knitting, and the same applies to the double top **1***b* shown in Figs. 2 and 3. The term "rear side" or "back" used throughout the specification refers to that side of the goods where the heads of the needle meshes lie.

It is of course possible to provide stockings knitted in circular fashion with single tops **1***a* and also flat-knit stockings with double tops **1***b*, in which latter case the entire double top **1***b* possesses plush loops on its rear side or a part thereof. As indicated in Fig. 2, a section **4** of the leg directly connecting with the top **1***b* may also be provided with plush loops.

The invention further covers stockings, in which the leg **2** and the upper portion **3** of the foot are worked so that the back of the fabric is located on the outside of the stocking and the other portions of the stocking, i. e. the heel, sole and toe, are connected by seam or transferring with the leg if the rear side where the plush loops are provided is to be reversed relative to the leg and top.

A portion of the leg connecting with the top may also be reinforced by plush loops on the back of the fabric, as shown in Fig. 3, where **4** designates the reinforced section of the leg **2**. This usually occurs where double tops **1***b* are provided.

If the rear side of the double top 1b and of the connecting section 4 is located on the other side of the stocking than that of the leg 2, connection between the section 4 and the leg 2 must be effected at the point of transition 4a (Fig. 3) by transferring during knitting, seaming or linking.

These various possibilities of forming tops may be combined with reinforcements. As Figs. 1 and 4 show, the usually spliced portions are the high heel 5, the heel 6, the sole 7, the toe 8, the heel angle 9, the portion 10 between toe and sole and the portion 11 which forms the connection between the toe 8 and the upper foot portion 3. According to the invention, all these portions or a part thereof are provided in different combinations with plush loops on the rear side of the fabric. Forming part of the foot, these portions require maximum elasticity, great softness and strength, as well as security against runs and, in addition, must keep warm without any visible change in the mesh structure on the right fabric side which for these portions is always the outer side of the stocking. Furthermore, the high heel 5 or only a portion 5a thereof (Fig. 3) which connects with the heel 6 is fitted with plush loops on the rear side of the fabric. No matter whether the leg 2 and the upper foot portion 3 show the back on the outside or inside, the rear side of the high heel will preferably be disposed on the inside of the stocking.

For ornamental or other purposes the plush loops of the foot portions mentioned above may be disposed also on the outside of the stocking, so that the rear side of these portions lies outside. In such cases the plush may be arranged so as to show a colored or plain design. In addition to the high heel 5, the sole 7, and the toe 8, the heel angle 9 and the reinforceable portion 10 may have plush loops on the rear side of the fabric, and some courses of the upper foot portion 3 may possess them also to impart strength to the transition. This narrow piece of fabric is indicated 11 in Fig. 3. In legs having the rear side outside the high heel 5 or a portion 5a thereof, the heel angle 9, the portion 10 between toe and sole, a few courses 11 of the upper foot portion 3 and the sole 7 may be fitted with plush loops.

These different combinations of specially reinforced portions of stockings in which the top is provided with plush loops on the rear side of the fabric apply also to stockings made partly on a flat knitting machine and partly on a circular knitter. Fig. 4 shows such a stocking, in which the leg with top is knitted on a flat knitting machine and the foot portions, such as the heel 6, sole 7, toe 8 and portion 10 are worked on a circular machine. The leg 2 and the upper foot portion 3 are united with the circularly knit foot portions by transferring, linking or sewing. The stocking shown in Fig. 4 represents a combination of different features. The single top 1 is provided on its rear side, but on the outer side of the stocking, with plush loops. The circularly knit heel, sole and toe as well as the reinforcement 10 possess, however, plush loops on their rear side, which are on the inside of the stocking and therefore not visible on the outside. The rear side of the leg 2 and of the upper foot portion 3 may be placed on the inside or outside of the stocking.

Fig. 5 shows for example how the rear side of the entire stocking except the double top thereof is arranged inside, so that the top 1b is united with the leg 2 by a seam 12 and the plush loops of the top are on the outside. Either the entire top (Fig. 5) or only the half of it showing on the outside of the stocking (Fig. 5a) may be fitted with plush loops. The seam 12 must be elastic. Instead of by sewing connection can be established by transfer to the needles of the knitting machine, or the top may be seamlessly worked on the knitting machine.

This special reinforcement of different portions of the stocking may further be carried out in such manner that plain or colored designs are produced, for instance by omitting plush loops in portions where they are positioned on the right fabric side and on the outside of the stocking or by employing differently colored plush loops.

Fig. 6 shows how a design can be produced in a top 1 by omitting plush loops in every course. 13 indicates where plush loops are located.

Fig. 7 gives an idea of a colored design, the differently colored portions being designated 14.

Designs may also be produced by pressing or printing or by a combination of both methods.

MAX NEBEL.

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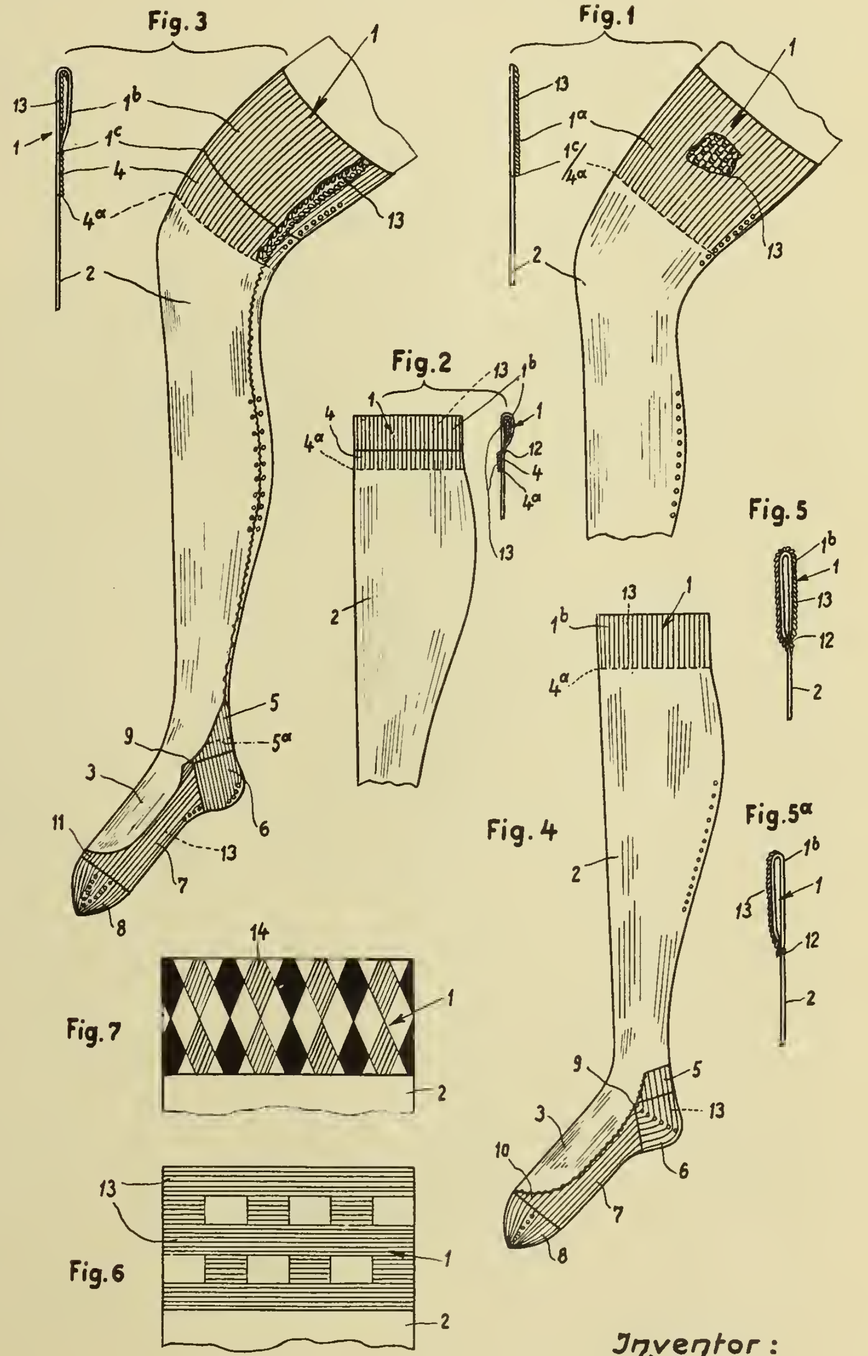

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Published May 4, 1943 Serial No. 226,453

ALIEN PROPERTY CUSTODIAN

METHOD OF ASCERTAINING THE MOISTURE CONTENT OF DOUGHY MASSES

Willy Brandt, Gross-Harrie bei Neumunster, Germany; vested in the Alien Property Custodian

Application filed August 24, 1938

In dealing with doughy masses, especially with flour dough, it is desirable to maintain the moisture content of the dough, i. e. the yield of dough, uniformly at a predetermined value, so as to obtain as far as possible uniform baked products in spite of variations in the moisture content of the flour and in its varying moisture absorbing properties, and, on the other hand, to save the quantities of flour, often added in excess of the predetermined amount, which may unfavourably affect the quality of the baked products. Even when the individual constituents and ingredients are accurately measured, it is impossible to be certain of obtaining a definite moisture content in the finished dough. Known methods of determining the moisture content in solid or fluid materials by heating samples in a closed space and observing the pressure and volume variations are too troublesome and time devouring to be usefully employed in the measurement of the moisture content of doughy masses such as flour dough. All known devices for determining the moisture content of grain, flour or other solid substances are intricate and costly, they are difficult to handle and the test takes too long to complete. In the preparation of dough, however, the individual operations succeed at definite short intervals, owing to the fermentation processes brought into play, so that only a very short time is available for examining and remixing the dough, and if this is exceeded the subsequent addition of flour or water is impossible.

The object of the invention is to provide a method which makes it possible to determine the moisture content of doughy masses in a very short time and with extremely simple and easily handled means, and which is especially suitable for examining flour dough or similar doughy masses and meets the requirements of practice in carrying out the test as fast as possible, by drying a sample and measuring the loss in weight.

This is attained by pressing a sample, after its weight or volume has been ascertained, into a thin layer, the moisture content of which is evaporated or driven off by direct heating applied to the surfaces in contact with the pressure plates and is determined by finally measuring the weight or volume of the treated sample. For this purpose an apparatus is used, in which the device for applying the pressure serves at the same time as the evaporating means, and is combined with the weighing and indicating devices into a complete unit. If it is desired to prevent the sample of dough from adhering to the pressure and heating plates after evaporation, it is preferable to insert thin layers of paper, or other permeable and heat conducting material, between the sample and the pressure and heating plates.

A constructional form of an apparatus for carrying out the method according to the invention is shown diagrammatically in the drawing.

Fig. 1 shows in side elevation the pressing, heating and weighing apparatus.

Fig. 2 shows the upper pressure plate with the heating device.

Fig. 3 shows the lower pressure plate with heating device.

In carrying out the method, a sample of the finished dough, e. g. about 10 grms, is taken and pressed between two plates of a pressure device into a layer as thin as possible and of large area. The surface of this thin layer is then submitted to a sudden intense heating through the heating surfaces or plates which are brought into contact with it, so that, by using a suitable high temperature above about 160° C., the moisture contained in the doughy mass is evaporated and driven off. The sample layer is of such a thickness that, by exposing as large a surface as possible to the heating, the moisture content of the sample is completely evaporated within quite a short time, e. g. within a fraction of a minute or some such time, without burning the other constituents of the layer, such as the flour ingredients or the like. Finally, the moisture freed sample layer is weighed, alone or together with the heating or pressure device, according to how the weight of the sample of dough was ascertained before the start of the pressing and drying operations. The difference between the weight of the sample of dough before and after the treatment in accordance with the invention gives the desired measure of the moisture content of the mass of dough being tested, which is calculated according to the formula:

$$\text{Yield of dough} = \frac{\text{Weight of dough} \times 100}{\text{Quantity of flour}}$$

According to whether the ascertained moisture content of the doughy mass agrees with, or deviates from, the desired value, the dough may be submitted to the further stages of baking straight off, or flour or water may be added before further treatment until the moisture content reaches the desired value. The test in accordance with the invention is preferably performed after the doughy mass has been completed, i. e. after all additional ingredients have been mixed in, such as the main mass, leaven and so on.

The apparatus for carrying out the method

described above may, in its simplest form consists in two presser plates 1, 2 with flat surfaces adapted to compress the sample 3 into as thin a layer as possible. Furthermore, the presser plates 1, 2 may be arranged to serve simultaneously as heating plates, by providing the sides which come into contact with the thin layer 3 with a gas, spirit or electric heater 4 and heating surfaces 5, 6 respectively. The presser or heating plates 1, 2 are preferably arranged to be held at an exact distance apart, after the pressing operation has been carried out on the dough sample 3, by means of the spacing blocks or members 7. For the sake of easy handling, it is advisable to lay the dough sample 3 between two paper sheets or pieces of material 12 specially designed for this purpose, so that the dough sample 3 does not come into direct contact with the heating surfaces 5, 6 of the presser plates 1, 2 and so cannot stick to them. The separating layers 12 of paper or other material are only used once and are of uniform size and equal known weight. By means of a timing device set at the beginning of the drying process, the presser or heating plates 1, 2 may be automatically lifted away from the sample, or the heating operation may be otherwise terminated. If the heating or pressure plates 1, 2 are separated by hand, they are provided with handles 8 on the sides. The heating device may be provided with a clearly visible temperature scale. In order to improve the compactness of the whole apparatus, the presser and heating device may be combined with a corresponding balance 9, with pointer 10 and scale 11, so that the method may be carried out in the smallest possible space and in the shortest time. Furthermore, the scale of the balance can be graduated so that the moisture content of the sample can be read off directly from the position of the pointer. If the weighing device only indicates the loss of weight of the sample of dough 3 dried out by the heating, the corresponding moisture content may be read or calculated from tables. The individual devices may, of course, also be set up and used separately, according to what is desirable in practice. Instead of weighing the sample 3 before and after the drying process, the volume may be measured, so as to determine the moisture content of the sample from the difference in volume before and after the drying process and the complete removal or evaporation of the liquid constituents. The invention is equally applicable in all cases where it is desired to test the moisture content of doughy masses in the shortest possible time and with the simplest possible means, without specialized knowledge.

WILLY BRANDT.

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MAY 4, 1943.
BY A. P. C.

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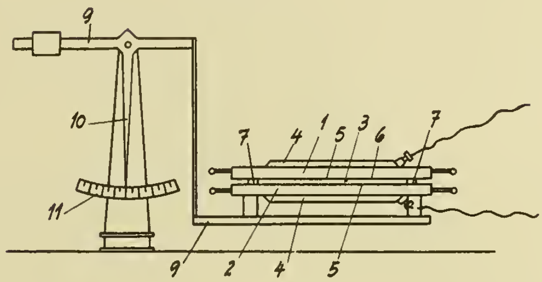
METHOD OF ASCERTAINING THE MOISTURE
CONTENT OF DOUGHY MASSES
Filed Aug. 24, 1938

Serial No.
226,453

Fig. 1



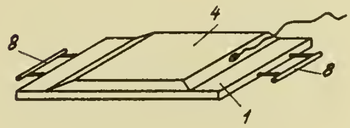


Fig. 2

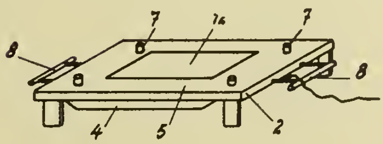


Fig. 3

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ALIEN PROPERTY CUSTODIAN

PRINTING MECHANISMS FOR BOOKKEEPING MACHINES

Kurt Aurbach, Bielefeld, Germany; vested in the Alien Property Custodian

Application filed August 24, 1938

The invention relates to a printing mechanism for bookkeeping machines having two balance mechanisms.

The posting of a series of entries consisting of the old balance of an account and a contra-account, the debits and credits, and the new balance of an account and a contra-account has previously been carried out by first posting the old balance, the debits and credits, and the new balance of the account and thereupon the old balance, the debits and credits and the new balance of the contra-account at one and the same printing place.

The primary object of the present invention is to consolidate and reduce in number, as far as possible, the machine operations for posting an account and a contra-account, by carrying out the posting of the debits and credits for the account and for the contra-account in a single machine operation. In accordance with the invention the debits and credits are entered in separate columns on both the record sheets for the account and the contra-account, but in reverse arrangement; that is to say, items entered as credits on the account record sheet are entered in the debits column of the contra-account record sheet.

A further feature of the invention is that the printing place for the contra-account is rendered inoperative in posting a series of entries relating only to the old balance, one or more debits and credits, and the new balance of a single account, whereas in posting a series of entries relating to an account and a contra-account and consisting of the old balance of the account and the contra-account, one or more debits and credits, and the new balance of the account and the contra-account, the printing place for the contra-account is rendered operative.

A further feature of the invention is the provision of means for indicating which of a plurality of printing places are operating during a given machine operation.

Other improvements relate to the drive of the printing hammers.

One illustrative embodiment of the invention is shown in the accompanying drawing, which shows particularly the printing mechanism of a bookkeeping machine, other parts of this machine being described in my copending application Serial No. 226,468 (F-20311).

Fig. 1 is a perspective view of the entire machine;

Fig. 1*a* is a diagram of the setting field of the machine;

Figs. 2 and 2*a* are parts of one vertical section of the printing mechanism parallel to the face of the machine.

Fig. 2*b* is a detail sectional view of the spring driving mechanism for one of the printing hammers;

Figs. 3 and 3*a* are parts of a plan view of the printing mechanism, with portions broken away;

Fig. 4 is a plan view of a portion of the mechanism for controlling the special sign type wheel frame;

Fig. 5 is an elevation of the printing mechanism from the right side, with parts in section and parts omitted;

Fig. 6 is a vertical section of a portion of the slide mechanism controlling the special sign printing mechanism, taken on the line 6—6 of Fig. 2;

Fig. 7 is a horizontal section of another portion of the mechanism controlling the special sign printing mechanism, taken on the line 7—7 of Fig. 2;

Fig. 8 is a vertical section of a portion of the feeler mechanism, on the line 8—8 of Fig. 2;

Fig. 9 is a horizontal section of a detail of the printing hammer control, on the line 9—9 of Fig. 2;

Figs. 10–13 are side elevations of several slides constituting a part of the mechanism controlling the special sign printing mechanism;

Fig. 14 is an upwardly directed view of a horizontal section through a portion of the same slides, on the line 14—14 of Fig. 2;

Fig. 15 is a horizontal section of a portion of the printing mechanism showing a feeler and a portion of a record sheet holder in plan view;

Figs. 16 and 16*a* are respectively a side elevation and edge view of a slide forming part of the feeler mechanism;

Fig. 17 is a side elevation of one end of a rail forming part of the mechanism controlling the special sign printing mechanism;

Figs. 18 and 19 respectively show the upper portions of an account card and a contra-account card;

Fig. 20 is a plan view of a portion of an amount printing wheel frame;

Fig. 21 is a vertical section through the setting mechanism showing in side elevation a bank of amount keys and parts of a differential mechanism controlled thereby;

Fig. 22 is a partial plan view of the machine with casing removed showing the amount setting mechanism and printing mechanism controlled thereby;

Fig. 23 is a somewhat diagrammatic vertical section of a portion of the setting mechanism showing in side elevation several special setting keys taken from different parts of the keyboard and consolidated in one bank in this view, to show the blocking mechanism controlled by them;

Fig. 24 is a fragmentary plan view of the key bank as shown in Fig. 23;

Figs. 25 and 26 are two diagrams showing the sequence of operations of the printing mechanisms;

Fig. 27 is a laterally expanded perspective view of the mechanism interconnecting the special keyboard and the printing mechanism;

Fig. 28 is a vertical section of a portion of the special keyboard showing mechanism controlling the engagement of one of the balance mechanisms;

Fig. 29 is a vertical section of a portion of the special keyboard;

Fig. 30 is a vertical section of a portion of the special keyboard showing adjusting mechanism for one of the balance mechanisms;

Fig. 31 is a vertical section of a portion of the special keyboard;

Fig. 32 is a vertical section of a portion of the special keyboard;

Fig. 33 is a side elevation of the keys for subtotal and grand-total with the appurtenant slide.

The bookkeeping machine shown has two balance mechanisms, I and II, for keeping an account and a contra-account, respectively. There are five printing places (Figs. 2 and 2*a*), one at B for the account card, one at D for the contra-account card, one at A for the account book, one at C for the receipt, and one at E for the control strip.

The printing mechanism for the amounts is carried by two frames, one for the upper printing places and the other for the lower ones. Each frame is composed of longitudinal bars **700** (Figs. 2, 2*a*, 3, 3*a*, and 20) and struts **701**. The type wheels **703** are rotatably mounted on shafts **702** extending between the side bars **700**. The type wheel frames are guided by their longitudinal bars **700** upon transverse bearing plates **704**. There are five different assemblies of amount type wheels, corresponding to the five printing places. Each assembly is composed of four sets of type wheels mounted in a staggered arrangement, as shown in Fig. 20. The entire frame can be moved longitudinally of the bars **700**, in order to bring a selected one of the several sets of printing wheels up to the printing line at each printing place.

The differential setting of the type wheels is performed by rack bars **705** driven by toothed wheels **706** (Figs. 2*a* and 21). The toothed wheels **706** are non-rotatably mounted upon longitudinally grooved shafts **707**. Their setting is controlled by the setting keys **31** (Figs. 1 and 21) for the amounts. The keys **31** operate for this purpose upon a differential mechanism comprising differential gears **311** meshing with rack bars **312** guided for vertical movement by rectangular bars **313** and having at their lower ends punched holes **314** meshing with pinions **315**. The mechanism for stopping the differential gears **311** by the depressed keys is not shown in the drawing, since it forms no part of the invention. The gears **311** are rotated in the conventional manner in each machine operation in which an amount is entered, until stopped by the depressed amount keys **31**. Each pinion **315** is pinned rigidly to a shaft **316**, which has fixed to its other end a toothed wheel **317**. With the toothed wheel **317** meshes a toothed wheel **318** rigidly fastened upon a shaft **707**, which has fixed to it a pinion **706** for each of the four sets of printing wheels of which each assembly is composed. Each driving wheel **706** stands in engagement with two rack bars **705** above and below, which are in mesh at their opposite sides with the type wheels **703** rotatably mounted upon shafts **702**. There is an upper set of rack bars **705** for the printing wheels of assemblies A, E and C and a lower set of rack bars for the printing wheel assemblies B and D. In the present case since the assemblies are composed of four sets of printing wheels, with nine wheels in each set, there are required nine shafts **707**, each with four transmission wheels **706**, and nine rows of keys for the respective shafts **707**. The drawing shows only a part of the full complement of these wheels and shafts. Setting levers might be used in place of key banks to set the shafts **707**.

The type wheel frames for the amounts are displaced, in order to bring the sets of printing wheels into printing position, by a rack bar **708** adjacent the inner casing wall **506** (Fig. 3), which meshes with a toothed wheel **709**. The toothed wheel **709** is fixed upon a shaft **710** (Figs. 2 and 3), which is rotatably mounted in the casing walls **506**, and has secured to it pinions **711** meshing with teeth **712** of longitudinal bars **700**. The rack bar **708** is extended downward at its right end (Fig. 2) in the form of a plate **713** provided with a series of teeth **714**, which mesh with a pinion **716** pinned upon a shaft **715**. Upon shaft **715** there is also fixed a coupling disk **717** provided with a hub **720**. The coupling disk **717** holds a series of coupling pins **719** which are under the influence of compression springs **718**. The hub **720** of coupling disk **717** connects the disk rigidly to a guide disk **721** in which the other ends of pins **719** are guided. To each coupling pin **719** is rigidly connected a fork-shaped projection **722**, the projections **722** being respectively controlled by a series of forks **723** operated by special setting keys **8, 9, 10, 11, 15—22, 12, 13** (Figs. 1 and 1*a*) through mechanism to be referred to presently. These special setting keys serve, for instance, for setting the machine for printing the old balance, the debits, the credits, and the new balance. In any one machine operation one, and only one, of the pins **719** is projected beyond the plate **721** for engagement by a tong-like driver mechanism. This latter mechanism comprises two jaws **725** and **727** mounted respectively upon two nested sleeves **725*a*** and **727*a***. The inner sleeve **725*a*** is revolubly mounted upon shaft **715**. The sleeve **727*a*** bears a gear **726** and the sleeve **725*a*** bears a gear **724**. These gears mesh, respectively, with two rack bars **728** and **729** mounted upon the two forks of a slide **730**. The slide **730** is guided at its forked end upon sleeve **725*a*** and has a slot **730*a*** by which it is guided upon a hub of a cam disk **733** fixed to shaft **734**. The slide **730** has mounted upon it rollers **731** and **732** which bear upon the cam disk **733**. The shaft **734** to which the cam disk is fixed is driven through two bevel gears **735** and **736** from the driving mechanism of the machine (not shown). The cam disk **733** reciprocates the slide **730**, which, on its movement to the right (Fig. 2) rocks the jaw **725** counterclockwise and the jaw **727** clockwise, thus moving that one of the pins **719** which has been projected forward by a fork **723** to the position of

the pin numbered 719 in Fig. 2. The resulting rotation of the shaft 715 is transmitted through gear 716 and rack plate 714 to rack bar 708, thence through gear 709, shaft 710 and gears 711 to the rack bars 700. These rack bars serve to position the amount type wheel frame, the type wheels 703 rolling upon the rack bars 705 until the selected set of type wheels has reached the printing line. During this time, by the action of shafts 707, pinions 706, and rack bars 705 the type wheels 703 have been set by the differential mechanism, so that now the imprint of the amount thus set up, in the corresponding column of the record sheet, can follow.

It has been stated that the operation of the forks 723 which control the positioning of the amount totalizer wheel frame is determined by the special setting keys 8—11, 15—22, 12—13. For this purpose there is provided a series of slides 737—740 (Figs. 2, 3 and 5) to each of which one of the forks 723 is fixed. These slides are guided upon pins 741 and have bent-up flaps 742 notched at 743. Into the notches 743 project levers 744—747 rockably mounted upon a pin 751. This pin is fixed to an arm 87 of a bell crank lever rockably mounted upon a pin 88 secured upon the casing wall 506. The other arm of this bell crank lever bears a pin 89 engaging the forked end 90 of a lever 91 fixed upon a rock shaft 91a, which has a clockwise and counterclockwise movement in each machine operation. The upper ends of the levers 744—747 engage in notches 86, 161, 164, 213, 269 of rails 82, 160, 163, 212, 268, which are normally free to slide, but which can be individually blocked by a suitable mechanism controlled by the keys 8—11, 15—22, 12—13, as will presently be described. In any machine operation, when the lever 91 rocks clockwise the bell crank lever 87 rocks counterclockwise and all but one of the levers 744—747 rock about their lower ends, pulling the slides at their upper ends to the left. That one of the levers 744—747 whose upper slide has been blocked rocks about its upper end and moves that one of the slides 737—740 which is connected to its lower end to the left, thus thrusting forward the corresponding pin 719 in the manner previously described.

The slide 82 controls the setting of the amount type wheel frames in position to print in the old balance column. This slide is blocked by the operation of any one of the keys 15—22. For this purpose there is arranged beside this bank of keys a slide 38 (Fig. 29) mounted so as to move in either clockwise or counterclockwise direction upon depression of one of the keys 15, 16 or 19, 20. There is connected to the slide 38 a thrust bar 39, the opposite end of which acts upon a bell crank lever 58 rockably mounted upon a shaft 57 supported in the frame of the machine. To this bell crank lever is connected a bar 59 having two shoulders 60 and 61, which cooperate with two pins 62 and 63 fixed respectively to two toothed levers 64 and 65 (Fig. 27). A thrust bar 39a (Fig. 27) is similarly controlled by keys 17, 18, 21 and 22 and acts in the same way through a bell crank lever 58a and a shouldered bar 59a upon the pins 62 and 63. The toothed levers 64 and 65 are rockably mounted respectively upon shafts 66 and 67. To the lever 65 is connected, by a pin 69, a link 70, whose lower end is connected at 71 to the arm 72 of a bridge lever 73. The bridge lever 73 is rockably supported upon a shaft 74 and extends beyond the right hand side wall 68, where it is provided with an arm 74a attached to a pin 75. The pin 75 is connected to a link 76, whose other end is articulated to an arm 77 of a bell crank lever 78. The bell crank lever 78, is rockably supported on a pin 79 secured to a thrust bar 80. A bent-over end 78a of bell crank lever 78 coacts with a finger 81 of the bar 82 to block it.

In posting debits and credits to the account and the contra-account, it is necessary that items credited to the account be debited from the contra-account, and vice versa. For this reason the sets of printing wheels printing in the debit and credit columns of the account record sheet are stepped in reverse direction to the sets of printing wheels printing in the debit and credit columns of the contra-account record sheet (see Fig. 20). As indicated by the designated printing lines in this figure, the type wheel frame is in position to print in the credits column of the account and in the debits column of the contra-account.

The positioning of the amount type wheel frames to print in the debits column of the account is determined by blocking the slide 160, and its positioning to print in the credits column of the account is determined by blocking the slide 268. The mechanism for blocking these slides is controlled by the releasing keys 8 and 9. Beside the keys 8 and 9 (Fig. 28) is a slide 92 provided with cam faces 92a and 92b to be engaged respectively by pins 46 of the keys 8 and 9. By these cam faces the slide is moved either clockwise or counterclockwise. A bar 93 connected to the slide 92 is articulated at 94 to a bridge lever 95 rockably mounted on a shaft 96. An arm 97 of the bridge lever is connected to a link 98, whose lower end is articulated by a pin 99 to a bridge lever 100 rockably mounted on a shaft 84. The bridge lever 100 extends beyond the right-hand side wall 68 (Fig. 27), where it is provided with an arm 150 bearing a pin 151. The pin 151 projects into a slot 152 of a pawl 153, which is rockably mounted upon a pin 154. The pin 154 is fixed to a lever 155 rockably supported on shaft 74. Upon pin 154 there is also provided a thrust bar 156 having a slot 157 which embraces the pin 151. The thrust bar 156 has a bent-over arm 158 which coacts with a finger 159 to block the bar 160, and a second bent-over arm 266 which coacts with a finger 267 to block the bar 268; thus, the bar 160 will be blocked by depression of the key 9 and the bar 268 will be blocked by depression of the key 8.

The positioning of the amount type wheel frame to print in the new balance column is determined by the blocking of slide 212. The mechanism for blocking this slide is controlled by the key 12. For this purpose there is mounted beside the key 12 (Fig. 31) a slide 193, which is moved counterclockwise by the pin 183 of key 12. The upper end 194 of this slide bears against an arm 195 of a bell crank lever whose other arm is connected by a link 197 to an arm 198 fixed to shaft 199. A second arm 200 fixed to this shaft is connected by a link 201 to a bell crank lever 202 rockably mounted on a shaft 66. A pin 203 fixed to lever 202 (Fig. 27) projects into a fork 204 of a bridge lever 205. This bridge lever is rockably mounted upon a shaft 169 and extends to the extreme right end of Fig. 27, where its arm 206 is connected to a thrust bar 207 guided by fork 208 upon pin 209. A lateral arm 210 of thrust bar 207 coacts with a finger 211 to block slide 212.

The keys 8—11 also have the function of setting the machine to engage one or the other of

the balance mechanisms for positive or negative operation by the differential mechanism. For the purpose of determining the positive or negative operation of the balance mechanism I, the bridge lever **100** (Fig. 28) has fixed to it a pin **101** which engages in a slot **102** of a rod **103**. The rod **103** is connected to a bell crank lever **104**, which is loosely rockable upon a shaft **105**. To the other arm of the lever **104** is connected a link **106**, which is articulated at its opposite end to a lever **108** secured to a shaft **107**. This shaft serves for lateral displacement of the balance mechanism I, according to whether it is to be operated for positive or negative registration of an amount.

The adjusting mechanism for the balance mechanism is described in my pending application Serial No. ——— (F–20 311).

The machine is set to engage the balance mechanism I by the following linkage. Upon the bar **98** is fixed a pin **109** adapted to act upon an arm **110** of a toothed sector **111**. The toothed sector **111** is supported upon a rod **112** and meshes with a toothed sector **113** rockably mounted upon rod **84**. An arm **114** of toothed sector **113** stands in contact with the pin **99**. The two arms **110** and **114** of toothed sectors **111** and **113** are connected by a spring **119**, which pulls them into contact, respectively, with pins **109** and **99**. A second arm **115** of toothed sector **113** carries a rod **116** which is coupled to a lever **117** secured to a shaft **118**. This shaft serves for setting the machine to engage the balance mechanism I with the differential mechanism.

The coupling mechanism for the balance mechanism is described in my pending application Serial No. ——— (F–20 311).

Similar mechanisms are provided for determining the positive or negative operation of the balance mechanism II and for setting the machine to engage this balance mechanism. For this purpose there is provided a second slide **263** having cam faces **263*a*** and **263*b*** (Fig. 30) coacting with the pins **46** of the keys **10** and **11**. The slide **263** is connected by a bar **264** to a bell crank lever **265** rockably mounted on shaft **128**. A link **245** on the other arm of this bell crank lever is connected by a pin **246** to a bell crank lever **247** rockably mounted upon the shaft **178**. A pin **248** on the bell crank lever **247** engages in a slot **249** of a link **250**. The left-hand end of this link **250** is connected to a bell crank lever **251** rockably mounted upon the shaft **105**. The other arm of the bell crank lever **251** is connected by a link **252** to an arm **254** fixed to a shaft **253** which serves for selection of the proper side (plus or minus) of the balance mechanism II. This selection is made through mechanism similar to that previously described for the balance mechanism I. The pin **246** which connects bar **245** to bell crank lever **247** extends over an arm **261** of a toothed sector **260** rockably mounted on shaft **178**. The teeth of sector **260** are in mesh with a toothed sector **256** rockably mounted upon a rod **257**. The sector **256** is connected by a link **258** to an arm **259** rigidly fastened on shaft **105**. This shaft sets the machine to engage the balance mechanism II with the differential mechanism in a manner similar to that previously described with reference to the balance mechanism I. The sector **256** has a rearwardly extending arm **255** connected by a spring **262** to the arm **261** of sector **260**. The arm **255** is held by the spring against a pin **233** fixed to the bar **245**. Movement of the bar either up or down will set the machine to engage the balance mechanism II with the differential mechanism, through the link **258**. Downward movement of the bar **245** will select the addition side of the balance mechanism II, by pulling rod **250** to the right, while upward movement of the bar **265** will simply cause the pin **248** to move to the left in slot **249**, leaving the balance mechanism II in position for engagement of the subtraction side.

In posting debits and credits to the account and the contra-account simultaneously, the balance mechanisms are simultaneously engaged with the differential mechanism, but for reverse operation. In these operations the machine is released by one of the keys **8** or **9**, which normally control the engagement of the balance mechanism I. Joint engagement of the two balance mechanisms under the control of the keys **8** or **9** is provided for by a mechanism controlled by the depression of a key in the banks **1** or **2** and a key in the banks **3** or **4**. This mechanism will now be described. There is suspended from the pin **109** on bar **98** a link **236**, at the lower end of which is a pin **235**. The pin **233** on bar **245** has suspended from it a latch **232** whose lower forked end **234** stands opposite the pin **235**. This latch is connected by a link **231** to an arm **230** of a bridge lever **228** rockably mounted upon a rod **229**. The other arm **227** of the bridge lever is connected to a bar **226**, the upper end of which is articulated to an arm **225** of a bridge lever **224**. The bridge lever **224** is rockably mounted on shaft **128** and has at its left end an arm **223** connected to a pin **222**. The pin **222** is fixed to one arm of a bell crank lever **220** rockably mounted upon a pin **221**. The pin **221** is fixed to an arm **219** of a bridge lever **218** rockably mounted on shaft **128**. The bridge lever **218** is integral with a bridge lever **140**, having two arms each bearing a pin **139** engaged by the forked end **138** of a bar **137**. The two bars **137** are connected by two bars **136** to two slides **135** mounted respectively beside the two key banks **1** and **2**. The depression of any key in the banks **1** or **2** will cause its pin **134** to cam the appurtenant slide **135** in clockwise direction, thus rocking the bridge levers **140** and **218** in the same direction and lowering the pin **222**. This movement of the pin **222** causes the latch **232** to approach, but not to engage the pin **235**. The additional movement required for this purpose is derived from the depression of a key in the banks **3** or **4**. For this purpose the downwardly extending arm of bell crank lever **220** is connected by a link **244** with a pin **243** fixed to an arm **242** of a bridge lever **241** rockably mounted on shaft **128**. The upwardly extending arms of bridge lever **241** are respectively engaged by the forked ends of bars **240**, which are connected by bars **239** to slides **238** respectively positioned beside the key banks **3** and **4**. Depression of any one of the keys in these two banks will cause its pin **237** to cam in clockwise direction the appurtenant slide **238**, thus rocking the bridge lever **241** in clockwise direction and lowering the pin **222** by a further amount sufficient to cause the engagement of latch **232** with pin **235**. With the latch in this position the mechanism for selecting the positive or negative side of the balance mechanism II and for setting the machine to engage the balance mechanism II will be operated jointly with the corresponding mechanisms controlling the balance mechanism I.

Special sign printing mechanism

The printing mechanism for the special sign (account number, contra-account number, clas-

sification, check number, date of transaction, etc.) consists of two frames formed of longitudinal bars 748 (Figs. 2, 3 and 5) and struts 749, in which frames the type wheels are rotatably mounted upon shafts 750. The type wheel frames are guided by their longitudinal bars 748 on the same transverse bearing plates 704 which guide the longitudinal bars 700. The setting of the type wheels is performed by rack bars 752 driven by toothed wheels 753. The toothed wheels 753 are non-rotatably mounted upon longitudinally grooved shafts 754, the angular position of which is set by differential mechanism similar to the amount differential mechanism, controlled by the setting keys 25—28, 8—11, 14—24, 29—30, 12—13, 33—37 (Figs. 1 and 1a).

The type wheel frames for the special signs are displaced by a rack bar 755 adjacent the inner casing wall 506 in Fig. 3, which meshes with a toothed wheel 756. The toothed wheel 756 is rigidly fastened upon a shaft 757 (Figs. 2 and 3) which bears toothed wheels 758 engaging series of teeth 759 on longitudinal bars 748. The shaft 757 is rotatably mounted in the casing walls 506. The rack bar 755 bears a pin 760, which engages in the fork 761 of a lever 763 rockably mounted upon a shaft 762. The lever 763 is formed with a toothed segment 764, the teeth of which mesh with a toothed wheel 765. The toothed wheel 765 is rigidly connected to a hub 766 which bears a coupling disk 767 and a guiding disk 768. These disks hold pins 770, which stand under the influence of springs 769 tending to move them toward the rear. The pins 770 are grooved at 771 (Fig. 4) and in these grooves engage the ends of a lever 772 which is rockably mounted upon a pin 773 riveted to the hub 766.

With one of the pins 770 is rigidly connected a fork-shaped arm 774, which is controlled by the special setting keys 25—28 for the debit and credit postings, or 8—11 and 29, 30 for taking a sub-total or end-total from the totalizers for the old balances, for the debits and credits, for the cancellations and corrective entries, and for the total debits and credits. With the pins 770 cooperates a tong-like driver, which receives its drive in the same manner as the one for the amount printing mechanism already described. The parts of this device are therefore given the same numbers with an index. The fork 775 is formed from a bent-over part of the slide 776 (Figs. 2, 3 and 5), which is guided upon the pins 741 and has a bent-up flap 777 with a notch 778. In the notch 778 engages a lever 779, which is also rockably mounted upon the pin 751. The other end of the lever 779 engages in a notch 164 of a bar 163 (Fig. 27). The bar 163 is blocked by the same mechanism which blocks the bars 160 and 268. For this purpose the arms 158 and 269 extend across to the bar 163 and coact, respectively, with fingers 162 and 162a.

For each of the keys 8—28 there is a totalizer. The adjusting and coupling mechanisms for the totalizers are described in my copending application Serial No. ———. (F-20 311).

Keys 29 and 30 are provided to set the machine for taking sub-totals and end-totals, respectively, from the totalizers. The total taking mechanism for the totalizers is described in the USA Patent 2 029,776.

The keys 29 and 30 position the amount type wheel frames to print in the new balance columns. For this purpose mechanism is provided to block the slide 212 under the control of the keys 29 and 30. A slide 319 (Fig. 33) is mounted beside the keys 29 and 30 and is connected to a bar 320 (Fig. 27). This bar is articulated to a bell crank lever 321 rockably mounted on shaft 96. The other arm of the bell crank lever is connected to a link 322 provided with a pin 323. This pin engages one forked arm of a bell crank lever 324 rockably mounted upon a shaft 299. The downwardly extending arm of this bell crank lever has a fork engaging a pin 325 on a bell crank lever 326 rockably mounted on shaft 182. The bell crank lever 326 is secured to a bridge lever 327 bearing at its right end an arm 328 rockably mounted on shaft 162. The arm 328 is connected to thrust bar 80. This thrust bar has an arm 329 adapted to engage a finger 211a on slide 212 to block the slide. The arm 329 also coacts with a finger 162b to block slide 163, which causes the special sign type wheel frame to be thrown into printing position.

The mechanism just described therefore accomplishes the movement into printing position of the type wheel frame for the special signs, on postings of debits and credits—particularly postings to the account and the contra-account—and on the drawing of a sub-total or end-total from the totalizers for the old balances, for the debits and credits, for the cancellations and corrective entries, and for the total debits and credits.

The posting date is printed by a set of type wheels 977 (Fig. 3). These are set by rack bars 752a extending sufficiently far to the right to mesh with a set of pinions 978 respectively fixed to a set of telescoping tubes 979 and a shaft 980. The tubes and the shaft have respectively fixed to them knurled wheels 981 by which they can be rotated to set the date type wheels.

The special sign type wheels 921 (Figs. 3, 3a and 5) for the date of the transaction (Figs. 18 and 19) in the assembly of special totalizer wheels present in printing position, in their normal setting, in which no transaction date is set, a type representing an arrow 922. This arrow has the purpose of indicating that the transaction date is the same as the posting date, for instance where interest begins to run from the day upon which the entry is printed on the record sheet. The operator of the machine therefore does not have to set the date of the transaction in the setting field of the machine in this case, but this would be necessary if the interest should be computed from a date prior to the date of posting upon the account card of the owner of the account, particularly in the case of transfers. When the date of the transaction is different from the posting date it is set by keys 37 through differential mechanism similar to the amount differential mechanism.

There are also provided type wheels 923 (Figs. 3, 3a and 5) in the assembly of special type wheels, whose type 924 (Figs. 18 and 19) leave an impression upon the record sheets which indicates that the balance mechanism I has been operated either positively or negatively. The arrow 924 pointing to the left in line 2 of the record sheets mean that in this posting the balance mechanism I has taken up a debit—(minus) amount—whereas the arrow 924 pointing to the right in line 3 of the record sheet indicates that in this posting operation a credit—(plus) amount—has been entered in the balance mechanism I. Whereas the double arrow indicates entries consisting of the old balance of an account and a contra-account, the debits and credits, and the new balance of an account and

a contra-account; simple arrows indicate a posting consisting simply of the old balance, the debits and credits, and the new balance of an account.

The type wheels 926 (Figs. 3, 3*a* and 5) in the amount type wheel sets 703 are provided with type (1, 2, Figs. 18 and 19), which indicate from which balance mechanism (I, II) the old balance was taken or from which balance mechanism the new balance was drawn.

The type wheels 923 set by the key 25—23 through differential mechanism similar to the amount differential mechanism.

The other type wheels in the group of special type wheels include those for printing the account number, the cantra-account number, a serial number, the number of the machine, the classification of the debit or credit item, and its identification number. These type members are set by the setting keys 33—36, with the exception of the serial number type wheels and the machine number. The latter is fixed, while the serial number type wheels are set by a special mechanism operated by the driving mechanism of the machine in a manner well understood and therefore not particularly described.

Printing hammer drive

There is a set of printing hammers 810A—810E, each being rockably mounted for coaction with one of the assemblies of printing wheels. Each printing hammer extends across the entire assembly of type wheels, including the amount type wheels and the special sign type wheels of each printing place; therefore the springs which operate the printing hammers must be made correspondingly strong, in order to produce perfect impressions upon the record sheets. Since, as already described, for certain entries (old balance, new balance) no special signs are printed upon the record sheets, but only amounts, a less forceful stroke of the printing hammers is sufficient to make a perfect impression upon the record sheets for these entries. Accordingly, means are provided to reduce the force of the printing hammers at certain operations. The printing hammer actuating mechanism and the means for reducing the force thereof at certain operations will now be described:—

The power which drives the printing hammers is derived from a series of pairs of springs 791, 791*a* (Figs. 2*a*, 2*b*, and 3*a*). The springs 791 are mounted upon bushings 792 and backed against a bearing plate 794 fixed by screws to a cross beam 787, which is screwed to the casing walls 506. The left ends of springs 791 bear against collars 790 loosely mounted upon bushings 792. Upon the opposite side of collars 790 are the springs 791*a*, which are mounted upon tubes 796. Within each bushing 792 is a thrust rod 793, the left end of each thrust rod being provided with a connecting member 798 attached by a pin 799 to a lever 801. The connecting member 798 has a shoulder 797 against which bears the left end of the spring 791*a*. The levers 801 are rockably supported upon a shaft 800 and bear rollers 802 which ride upon cams 803 fixed to a shaft 804. The cam disks 803 have steps 805 to release a stroke to the left of the rods 793, under the influence of the springs 791, 791*a*. The rods 793 which operate the lower printing hammers 810B and 810D are connected by pins 806 to the downwardly extending arms 809 of these printing hammers. The rods 793 which operate the upper printing hammers 810A, 810C and 810E are connected by pins 806 to bell crank levers 808 rockably supported on shafts 807. The upper arms of these bell crank levers are connected by links 811 to the respective printing hammers.

In machine operations in which the special sign type wheels are effective in addition to the amount type wheels, the combined force of the springs 791 and 791*a* is exerted upon the printing hammers. In machine operations in which only the amount type wheels print, the springs 791*a* act alone upon the printing hammers. For this purpose there is provided a plate 788 mounted by a hinge 786 upon the cross beam 787 and provided with a lip 789 adapted to engage behind the collars 790. An arm 785 on hinge 786 is connected by a pin 784 to a link 783, the right-hand end of which is attached by a pin 782 to the rack bar 755. This is the rack bar which moves the special sign type wheel frame into and out of printing position. The connections are such as to cause the plate 788 to block the collars 790 when the special sign type wheel frame is moved out of printing position.

Upon the shaft 807B there is mounted a bell crank lever 812, to which is connected a pitman 813. The pitman 813 has a fork 814 into which projects a roller 815 of a fork lever 817 rockably mounted upon a pin 816. In the fork of lever 817 engages a roller 818 of a lower parallel linkage 820, whose connecting members 821 cooperate with notches 822 of lower rack bars 705, 752 and with notches of the lower longitudinal bars 700, 748. To the upper parallel linkage 820 the pitman 813 is directly connected. A link 824 (Figs. 2*a* and 3*a*) is connected to lever 812 by means of a pin 823, the other end of the link 824 being connected to a lever 825 (Fig. 3*a*) rotatably mounted upon the shaft 800. The lever 825 has mounted upon it two rollers 826 and 827 which cooperate respectively with cam disks 828 and 829 pinned to the shaft 804. The effect of the engagement of the bars 821 with the notches 822 is to hold the rack bars 705, 752 and the longitudinal bars 700, 748, and thereby the amount type wheel frames and the special sign type wheel frames, after they have been set to a certain position.

The printing mechanism according to the present invention has further a device for indicating upon the inserted record sheets or the control strip during a posting operation those printing places at which an impression was taken or a record sheet inserted. This refers particularly to the cooperation of the printing places A, B, C, D, where the record sheets have to be inserted.

Upon the casing wall 506 (Fig. 2) there is mounted by means of screws 830 a plate 831, into which are riveted pins 832. Upon the pins 832 are rockably mounted bell crank levers 833, whose forks 834 cooperate with bolts 835, 836 (Figs. 5 and 7). The connecting bolts 835, 836 are guided in slots 839 of plate 831 and in slots 840 of a plate 841, which is rigidly connected with the plate 831 by means of stay bolts 842 and screws 843.

To the connecting bolt 835 is connected, by means of a screw 844, a rod 845 (Figs. 2 and 7), which is coupled by a pin 846 to a bell crank lever 847. The bell crank lever is rockably mounted upon a shaft 848 fixed to the casing wall 506. To the lever 847 is connected, by means of a pin 849, a link 850 (Figs. 2 and 8), which is articulated to a lever 851 rockably mounted upon a pin 852 secured to a bearing plate 853. Upon the lever 851 a feeling finger 855 is secured by a bolt 854. The finger 855 is adapted to come into

contact with a record sheet inserted in a printing table 507. The downwardly projecting end of bolt 854 bears a pin 856 engaging in the fork 857 of a lever 858. The lever 858 is rockably mounted upon a pin 859 fixed in the bearing plate 853 and has a nose 860 adapted to coact with a pin 861 fixed upon the printing hammer 810D, to block the printing hammer.

To the connecting bolt 836 (Figs. 2 and 7) is attached a link 862, which is connected by a pin 863 to a bell crank lever 864 rockably mounted upon a shaft 865 fastened to the casing wall 506. To the lever 864 is connected by a pin 866 a link 867 (Figs. 2 and 8) which acts upon a lever 868 rockably mounted upon a pin 869 fixed to a bearing plate 870. To the lever 868 a feeling finger 872 is connected by bolts 871, this feeling finger being adapted to engage a record sheet inserted in a printing plate 507C. To the lever 864 (Figs. 2, 8 and 9) is riveted a pin 873, which engages in a fork 874 of a slide 875. The slide 875 is guided by means of a pin and slot connection 876 upon a plate 877, which is secured to the casing wall 506 by two screws 878. The slide 875 has a recess 879, which cooperates with a pin 880 fixed to the printing hammer 810C, to allow free movement to the printing hammer unless the slide 875 is moved far enough to the right in Fig. 9 to block the pin 880.

Similar feeler and blocking mechanisms to those just described are provided for the printing places A and B and they are operated by cross bolts 835′ and 836′ corresponding to the cross bolts 835 and 836. Parts of these mechanisms have been shown and referred to by similar reference numerals with the addition of the mark (′). A detailed description of them would be repetitious.

Upon a connecting bolt 881 (Figs. 2 and 7) a rail 883 (Figs. 2 and 17) is guided by slots 882. This rail is provided with lugs 884 and has mounted upon it slides 885 and 886 (Figs. 2, 16, and 16*a*), which are pulled together against the lugs 884 by springs 887. The rail 883 is connected by a pin 888 to a bell crank lever 890 rockably mounted upon a shaft 889. The arm 891 of the bell crank lever is connected to a bar 892, which is driven by a cam disk (not shown) to impart during each tion to the lever 890 and then a counterclockwise machine operation first a clockwise rocking mo- rocking motion.

Upon the levers 833 there are fixed pins 893, which cooperate with slides 894—897 (Figs. 5, 6, 10–14) slidably mounted by slots 898 upon pins 899 fixed to plates 831 (Figs. 2 and 5). The slides 895 and 896 have abutments 900 and recesses 902, while the slides 894 and 897 have abutments 901. All of these abutments and recesses cooperate with the pins 893 fixed to the levers 833. There are two slides allotted to each printing place A, B, C, D, but there will be described in detail only the slides 894—895 which control the printing place C and the slides 896—897 for the printing place D, which are shown individually in Figs. 10–13. Those for the printing places A and B are similar and have similar numbers to which the mark (′) has been added (Fig. 14). In the slide 896 is riveted a pin 903, upon which is loosely revoluble a pinion 904 (Figs. 2, 5, and 14), which engages the teeth 905 of slide 895. For holding the pinion 904 against lateral displacement there is provided on the slide 894 an arm 906 forming a slot 907 along which the pin 903 is guided. The pinion 904 also meshes with a pinion 908 (Fig. 5), which is rigidly connected by a tube 909 (Figs. 3 and 5) with a pinion 910 and through an intermediate pinion 911 with a rack bar 752. By the rack bar 752 and the pinions 753 (Fig. 2*a*) type wheels 912 at the printing place A, B, C, D, E are set, under the control of the slides 894—897, as will presently be described, in order to print upon record sheets at these respective printing places (for instance the account card or the contra-account card shown in Figs. 18 and 19) identifying figures to show whether an impression was taken at the printing places C and D.

The slides 894—897 are provided with notches 913 (Figs. 2, 10–13) in which engage levers 914 and 915 (Figs. 2 and 6). The slides 894 and 895 are associated with the lever 914, and the slides 896 and 897 with the lever 915. The levers 914 and 915 are rockably mounted upon a pin 916 of a lever 917, which rocks upon a shaft 918. To the arm 919 of the lever 917 is attached a rod 920, to which an up and down movement is imparted during each machine operation by driving mechanism not illustrated.

The mechanism described for indicating the printing places at which an impression has been taken operates in the following manner:

Assume that record sheets have been inserted at the two printing places C and D. During the machine operation the feeling fingers 855 and 872 are moved into contact with the record sheets by the parts 851, 850, 847, 845, the cross bolt 835 which is straddled tongs fashion by the slides 885, 886, the lugs 884 of the rail 833, the lever 890 and the bar 892, which is moved by a cam disk (not shown). This motion is practically without influence upon the levers 833 connected to the cross bolts 835 and 836 and their pins 893 consequently remain in the path of abutments 900. Therefore only the slides 894 and 897 are moved to the right in Fig. 2, through the action of lever 917, which is swung by a cam disk (not shown), and the levers 914, 915, because the slides 895 and 896 are stopped by the pins 893 against their abutments 900. A displacement of the type wheels 912 therefore does not occur, because the slides 894 and 897 are not connected with the pinion which sets the type wheel 912. Consequently on all record sheets the sign 925 which normally stands in printing position is printed, indicating the use of the printing places C and D.

If a record sheet is inserted only at the printing place D, on the next machine operation only the feeling finger 855 is stopped by a record sheet, while the feeling finger 872 can pass through the printing table, because no record sheet is inserted. The movement of the printing finger 872 is sufficient so that the pin 893 of the second lever 833 from the left in Fig. 2 comes into position to stop the abutment 901 of slide 894. Therefore, during the machine operation of lever 917 the slides 895 and 897 are moved to the right, because the slides 894 and 896 are stopped and the lever 914, 915, which engage in the slides 895, 897 swing in clockwise direction. Since the teeth 905 of slide 895 are in mesh with the pinion 904, there is a one space movement to the right (Fig. 2) of the corresponding rack bar, resulting in a one space counterclockwise rotation of all type wheels 912 of the assemblies A—E, to bring into printing position the sign 925 which indicates the printing place D, in order to show that only at this place was an impression taken.

If a record sheet is inserted only at the printing place C, on the next machine operation only the feeling finger 872 is stopped by a record sheet, while the finger 855 passes through the printing table. The slides 895 and 897 are therefore blocked and the pinion 904 is rolled to the right on rack teeth 905 by its axle 903. This causes a two space movement of rack bar 752 to the left and a two space clockwise rotation of the type wheels 912, into position to print a sign indicating that an impression was taken only at the printing place C.

If no record sheets are inserted at either C or D, the slides 894 and 897 are blocked, the pinion 904 and rack teeth 905 move simultaneously to the right, imparting a one space movement to the left to rack bar 752 and a one space clockwise rotation to the type wheels 912, into position to print a sign indicating that no impression was taken at either C or D.

The printing places A and B have similar devices for detecting whether an impression is being taken and controlling printing members to print corresponding signs. With such a mechanism the advantage is achieved that all the signs necessary for indicating the printing places can be arranged on two type wheels 912, 912′ for each printing place.

The operation of the printing mechanism will now be described briefly once more as a whole:

As previously stated, the printing mechanism includes five printing places A-E. The printing places B and D are of particular importance to this invention, because an impression is taken in a single machine operation in posting debits and credits, both at the printing place B for the account and at the printing place D for the contra-account. At the same time it is necessary that in posting debits and credits, for example, a deposit of an account owner, an impression be made in the credits column of the account card, while the contra-account card an impression is made in the debits column (Figs. 18 and 19). For this purpose the sets of type wheels for printing debits and credits are arranged in reversed stepped position at the two printing places B and D (Fig. 20).

On posting debits and credits special signs are printed on all the record sheets, particularly those for the printing places A, B, D. The type wheels which print these special signs and which are mounted in a separate frame are only moved into printing position on posting debits and credits and in taking sub-totals and end-totals from the totalizers for the old balance, for the debits and credits, for the cancellations, for the corrective entries, and for the total debits and credits. The striking force of the printing hammer at each printing place is at the same time so regulated that on all other operations the striking force of the printing hammer is reduced by the action of the plate 788 (Fig. 2) blocking out all the printing springs 791. That is to say, upon movement of the special sign type wheel frame out of the printing position the plate 788 is moved to throw its lip 789 in front of the collars 790, so that only the much weaker springs 791*a* are operative.

The coordination of the individual printing places, particularly the printing places A, B, D for the account and the contra-account, makes it necessary to print a sign on the record sheets identifying those printing places at which a record sheet has been inserted and an impression made upon it. For instance, if record sheets are inserted at the places A, B and D and a series of entries is made, all of the inserted record sheets and the control strip show a sign from which it can be determined that an impression was made at the printing places A, B, D, while no record sheet was inserted and printed at the printing place C.

In order to ensure proper coordination, particularly of the printing places for the account (B) and the contra-account (D), in carrying out different kinds of bookkeeping operations, the printing hammer of the printing place D is normally blocked and is only released when an old balance key for the balance mechanism II is pressed and blocked again when the new balance is taken from the balance mechanism II, or when the total or sub-total are taken from the old balance totalizers for the balance mechanism II. For this purpose the following device is provided:

The printing hammer 810D for the printing place D is controlled by the setting means 17, 18, 21 and 22 (Figs. 23 and 24), the setting means 17 and 18 serving for old balances in the balance mechanism II and the setting means 21 and 22 for cancellation and corrective entries. (As stated in the brief description of Figs. 23 and 24, the keys shown in these figures are arranged differently in the machine and are shown in a single bank in these views only for convenience of illustration). The setting keys 17, 18, 21 and 22 act through their pins 747 upon a slide 927 which is under the influence of a spring 927′ tending to pull the slide downward. A pin 928 connects this slide to a bar 929, the opposite end of which is attached to a lever 931. The lever 931 is connected to a lever 934 rockably mounted upon a shaft 932 and under the influence of a spring 933. The lever 934 bears a roller 935, which coacts with a cam 937 fixed to a shaft 936.

Upon a shaft 938 is rockably mounted a lever 939, to which is connected a bar 940. The opposite end of this bar is articulated to a lever 941, which is connected to a lever 943 rockably mounted on a shaft 942. A bar 944 is connected to the other side of lever 943 and to a latch 946 which is rockably mounted upon a shaft 947 and pulled downward by a spring 945. The latch 946 has a hook 948 which engages behind a pin 949 fixed to the arm 809D of printing hammer 810D. The printing hammer 810D coacts with type wheels 703 of the printing place D for the contra-account. To the pin 749 is connected one of the previously mentioned rods 793, which is under the influence of springs 791 and 791*a* bearing against the stationary plate 794. The reciprocation of the rod 793 by the springs is controlled by a cam disk 803, as previously described.

The lever 943 has a hooked nose 950 and coacts with a nose 951 of a latch 954 rockably mounted upon a pin 952 and pulled in clockwise direction by a spring 953. A pawl 955 having a nose 956 adapted to coact with the latch 954 is attached to a lever 959 rockably mounted upon a shaft 957 and pulled in counterclockwise direction by a spring 958. The lever 959 has an upwardly extending arm upon which is mounted a roller 960 controlled by a cam 961. To the pawl 955 is attached a bar 963, whose other end is connected by a pin 964 to a slide 965. The slide 965 is controlled by a pin 47 of the setting key 13, which sets the machine for taking the new balance from the balance mechanism II.

The operation of the described mechanism is as follows:

If a series of entries is carried out which con-

sists of the old balance of an account and a contra-account, one or more debits and credits, and the new balance of the account and the contra-account, the contra-account is reckoned in the balance mechanism II. In this case the printing place D at which the contra-account card is printed must be made operative, which is done by pressing one of the releasing keys **17**, **18**, **21** or **22**. This moves the lever **931** into position to coact with lever **941**. Immediately after the release of the machine operation the cam **937** is turned in counterclockwise direction, whereby the latch **946** is removed from the pin **949**, through the intermediary of the parts **935**, **934**, **931**, **941**, **943**, **944**, thereby releasing the printing hammer **810**D. At the same time the nose **950** is caught by the latch **951** and the printing hammer remains released.

Now there can be carried out as many debit and credit postings as desired, without the printing hammer **810**D being locked again. Only on taking the new balance from the balance mechanism II does the latch **946** become operative after the impression is printed, and thereby the printing hammer **810** is again locked. This is accomplished by movement of the pawl **955** to the left by the action of slide **965**, to the dotted line position, followed by the action of cam **962** upon the parts **960**, **959**, **955**, which swings the latch **954** in counterclockwise direction, thus releasing the hooked nose **950** of the lever **943** and allowing the spring **945** to pull down the latch **946**.

In order to be able to use the printing mechanism D for printing on a reckoning sheet also in drawing an end-total or sub-total from the totalizers allotted to the keys **17**, **13**, **21** and **22**, the pawl **955** is also connected by a bar **966** with a slide **967**, by a pin **968**. The keys **29** and **30** for drawing sub-totals and end-totals act upon the slide **967** by pins **47**, which move the slide downward. By this motion the pawl **955** is brought into the range of latch **954**, so that immediately after each printing of a sub-total or end-total by the release of the latch **954** the printing hammer **810**D is locked, contrary to the condition in printing old balances and debits and credits.

The diagram of operation shown in Fig. 25 illustrates the control of the individual printing places in carrying out a series of entries consisting of the old balance of an account, one or more debits and credits, and the drawing of a new balance; whereas the diagram of operation in Fig. 26 shows the control of the individual printing places in carrying out a series of entries consisting of the old balance of the account and a contra-account, one or more debits and credits, and the drawing of a new balance of the account and the contra-account.

KURT AURBACH.

PUBLISHED K. AURBACH Serial No.

MAY 4, 1943. PRINTING MECHANISMS FOR BOOKKEEPING MACHINES 226,467

BY A. P. C. Filed Aug. 24, 1938 27 Sheets-Sheet 1

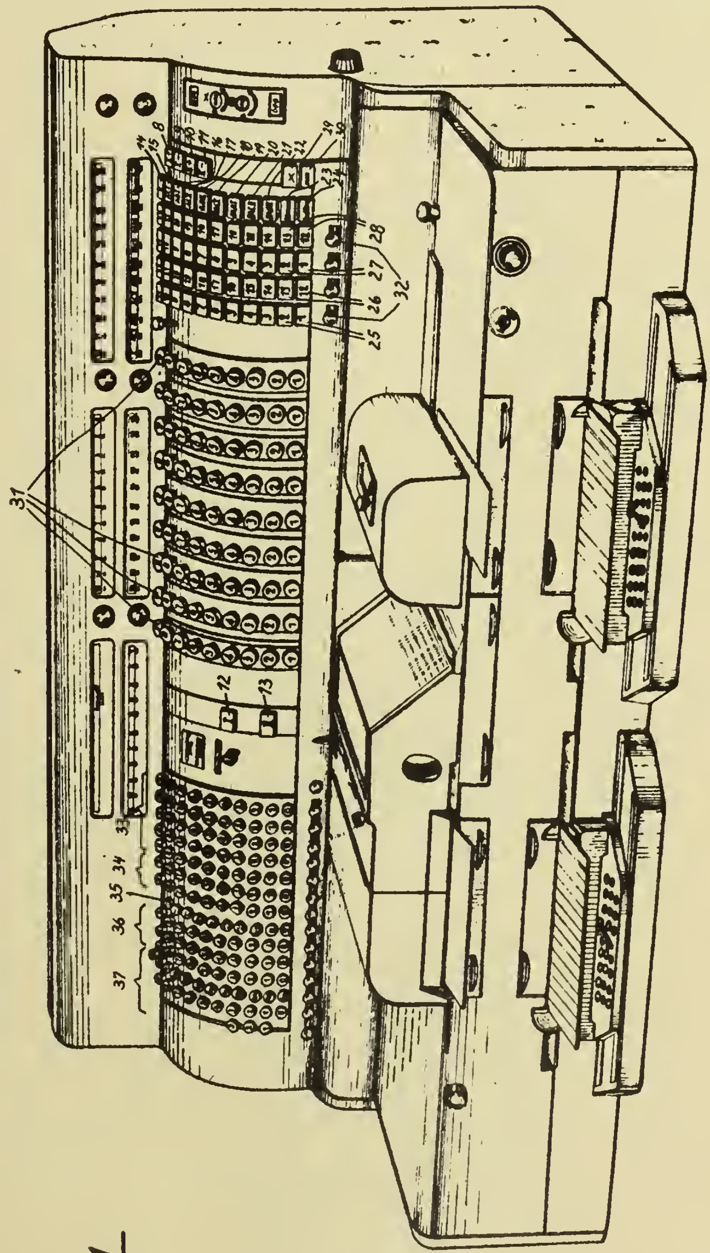

Fig. 1

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INVENTOR

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Serial No. 226,467

27 Sheets-Sheet 2

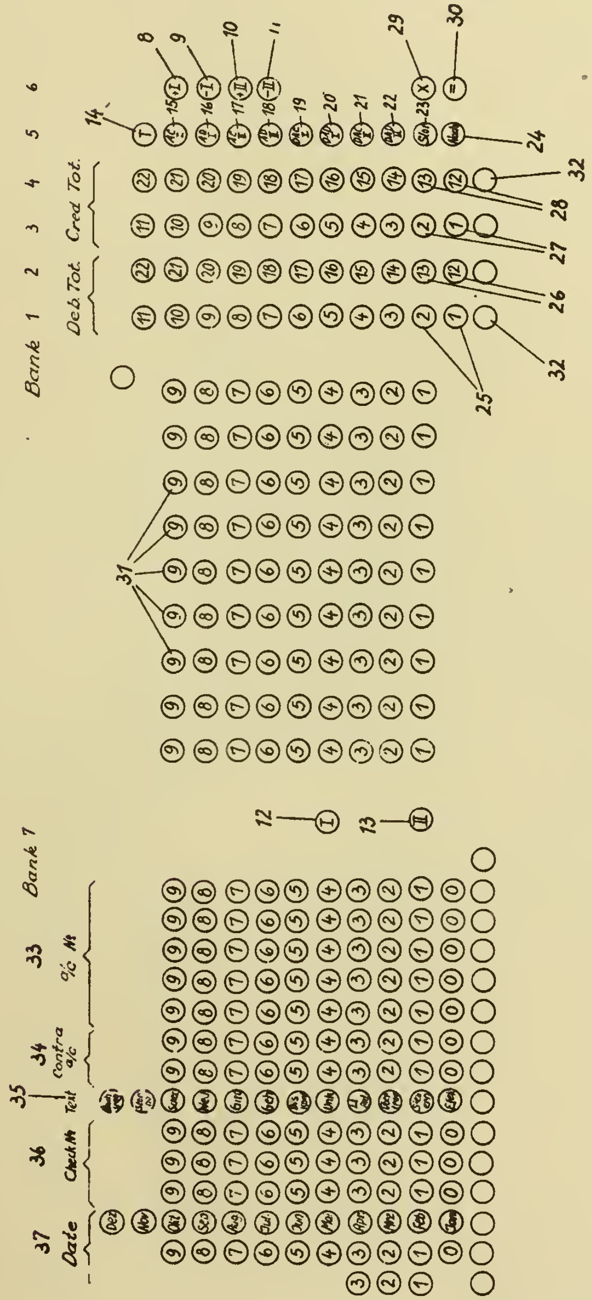

Fig. 1a.

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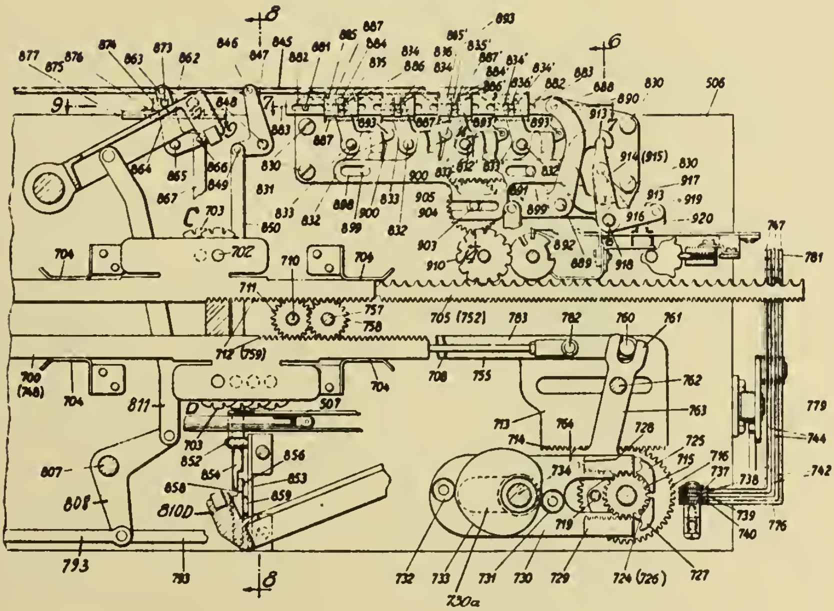
Fig. 2



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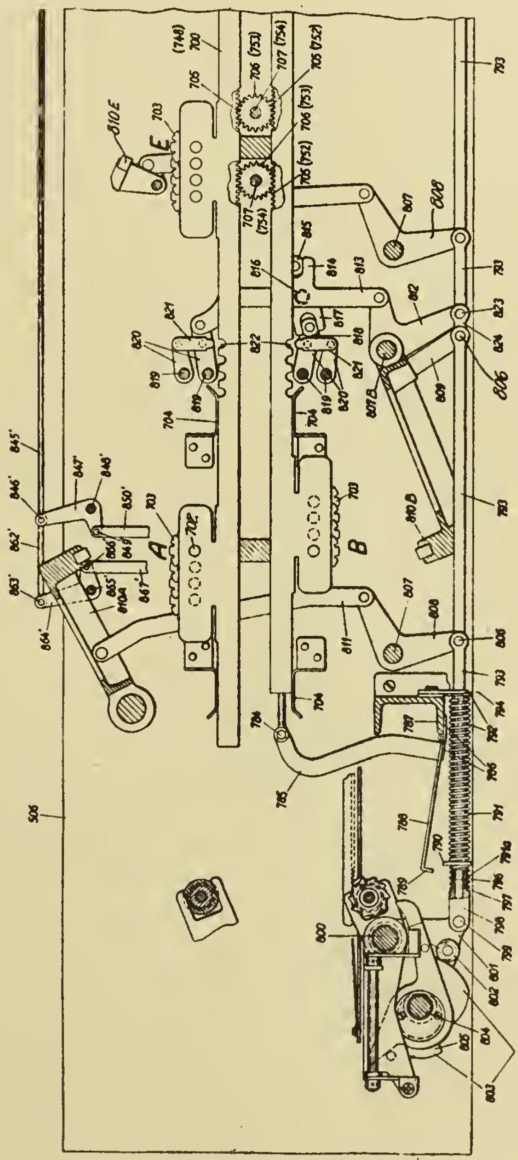

Fig. 2a

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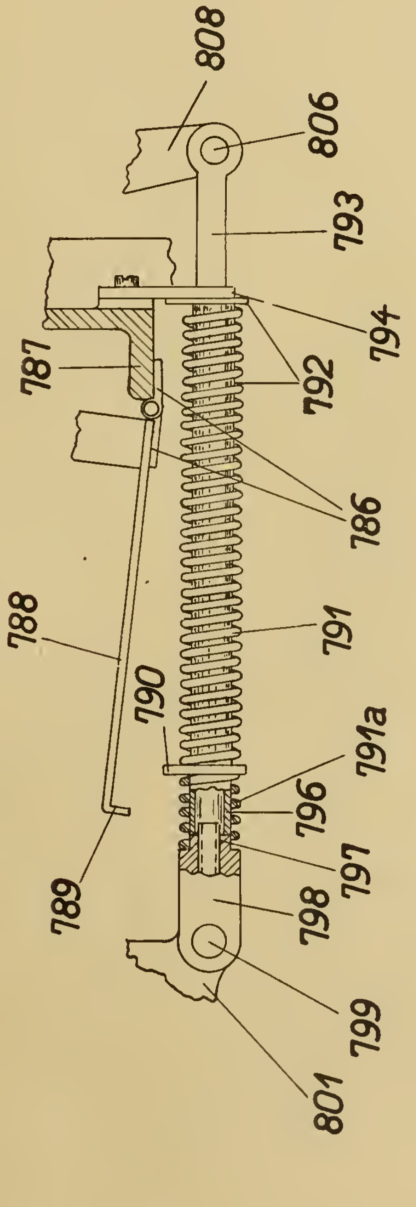
Fig. 2b



Kurt Aurbach
Inventor
By Knight Bros
His attorneys

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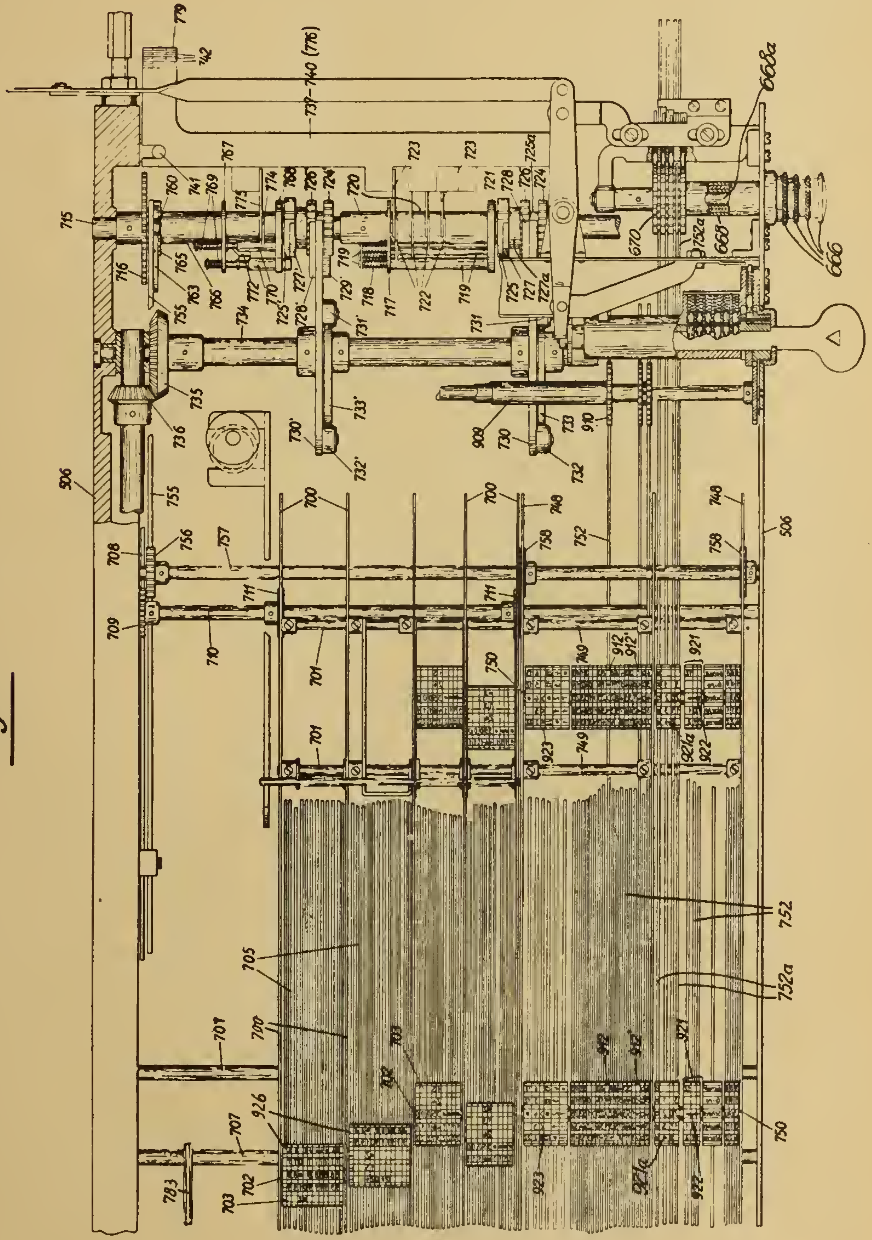

Fig. 3.

KURT AURBACH
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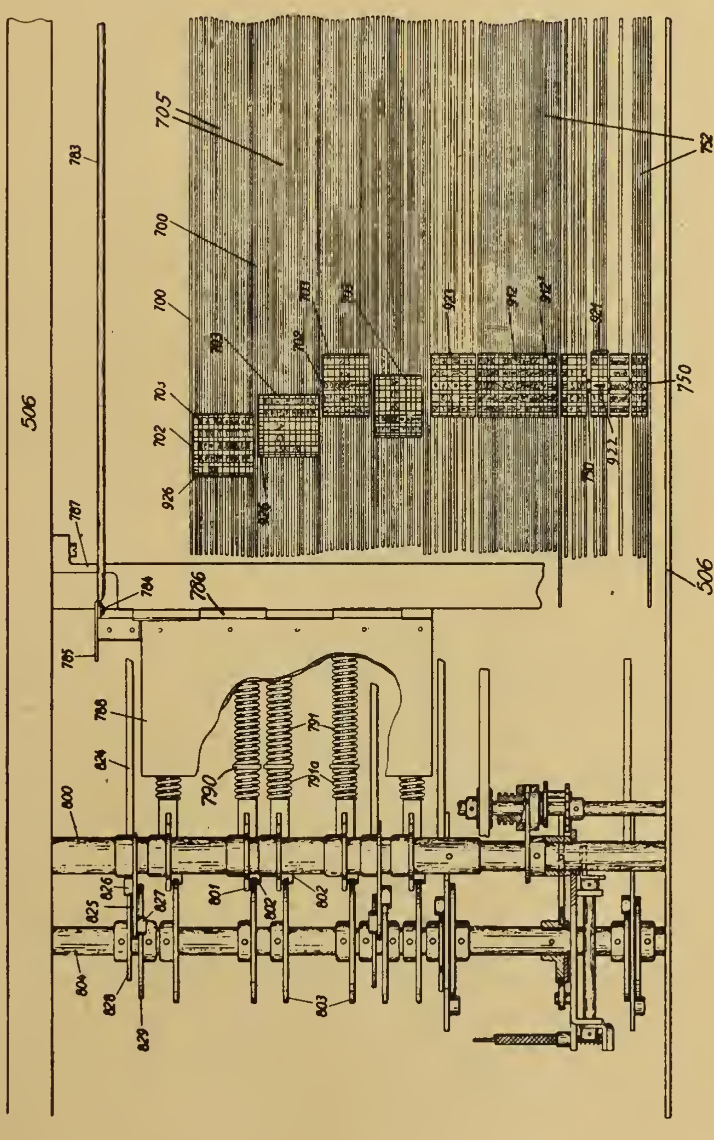

Fig. 3a.

KURT AURBACH
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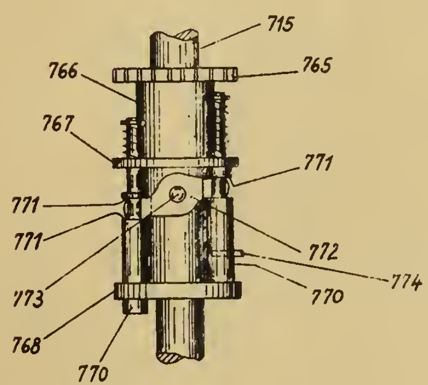
Fig. 4



KURT AURBACH
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BY Knight Bros

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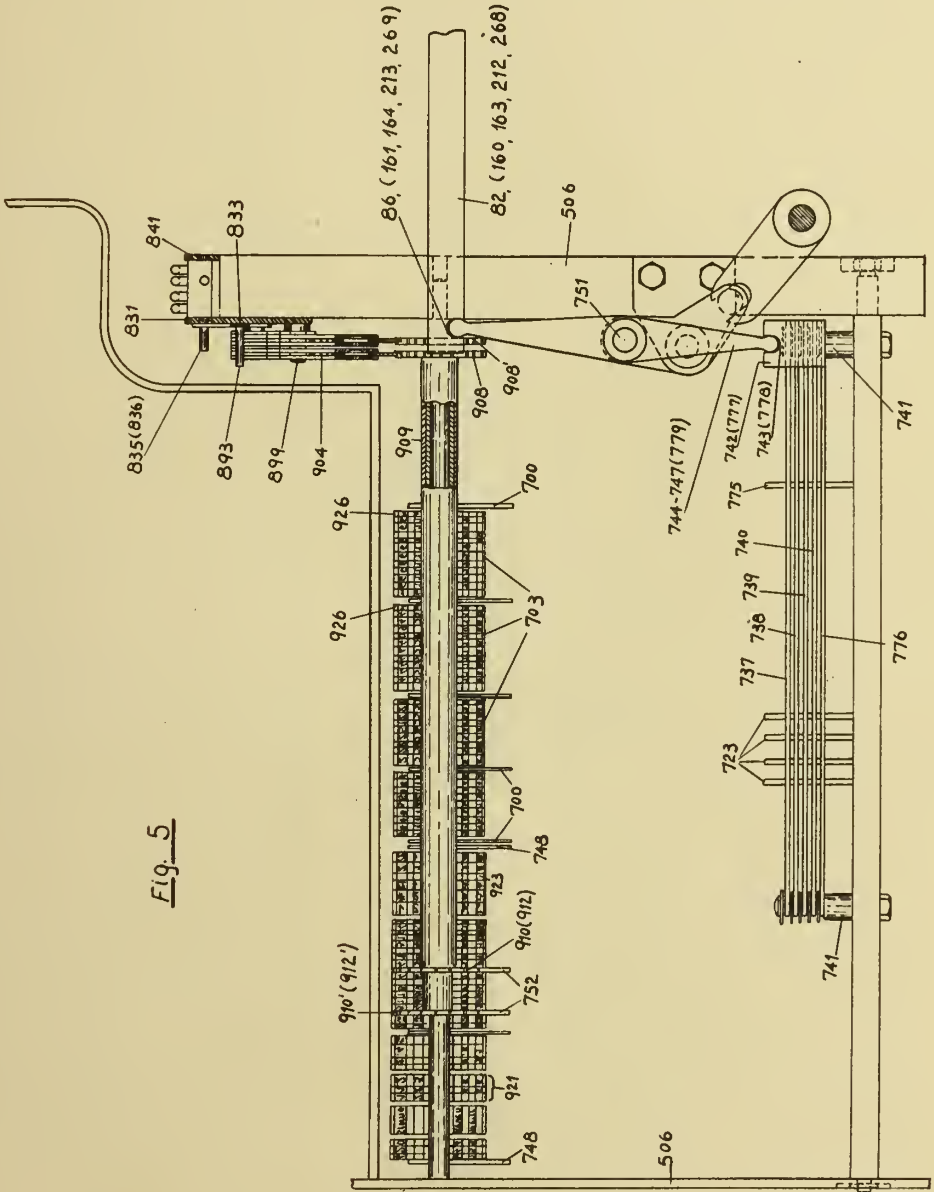

Fig. 5

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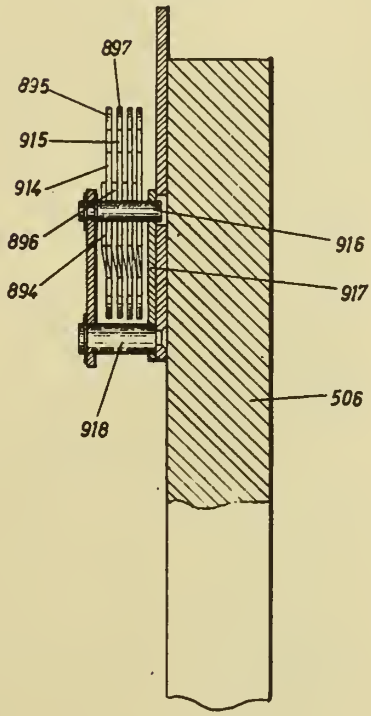
Fig. 6



KURT AURBACH
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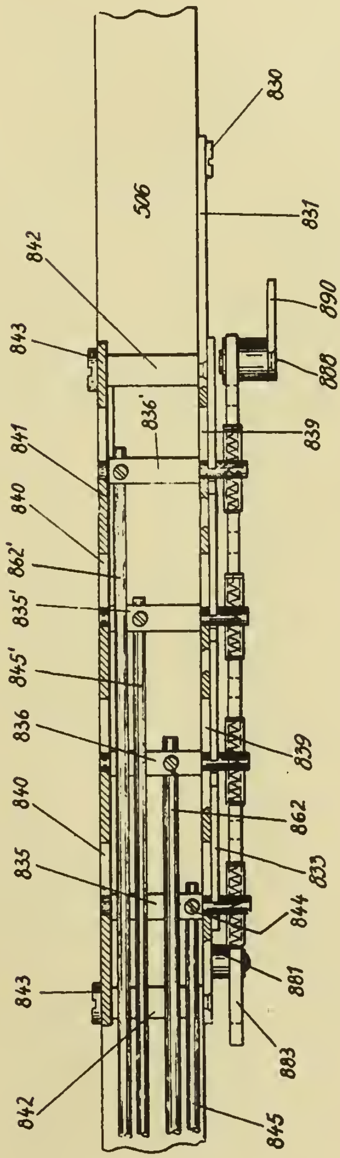

Fig. 7.

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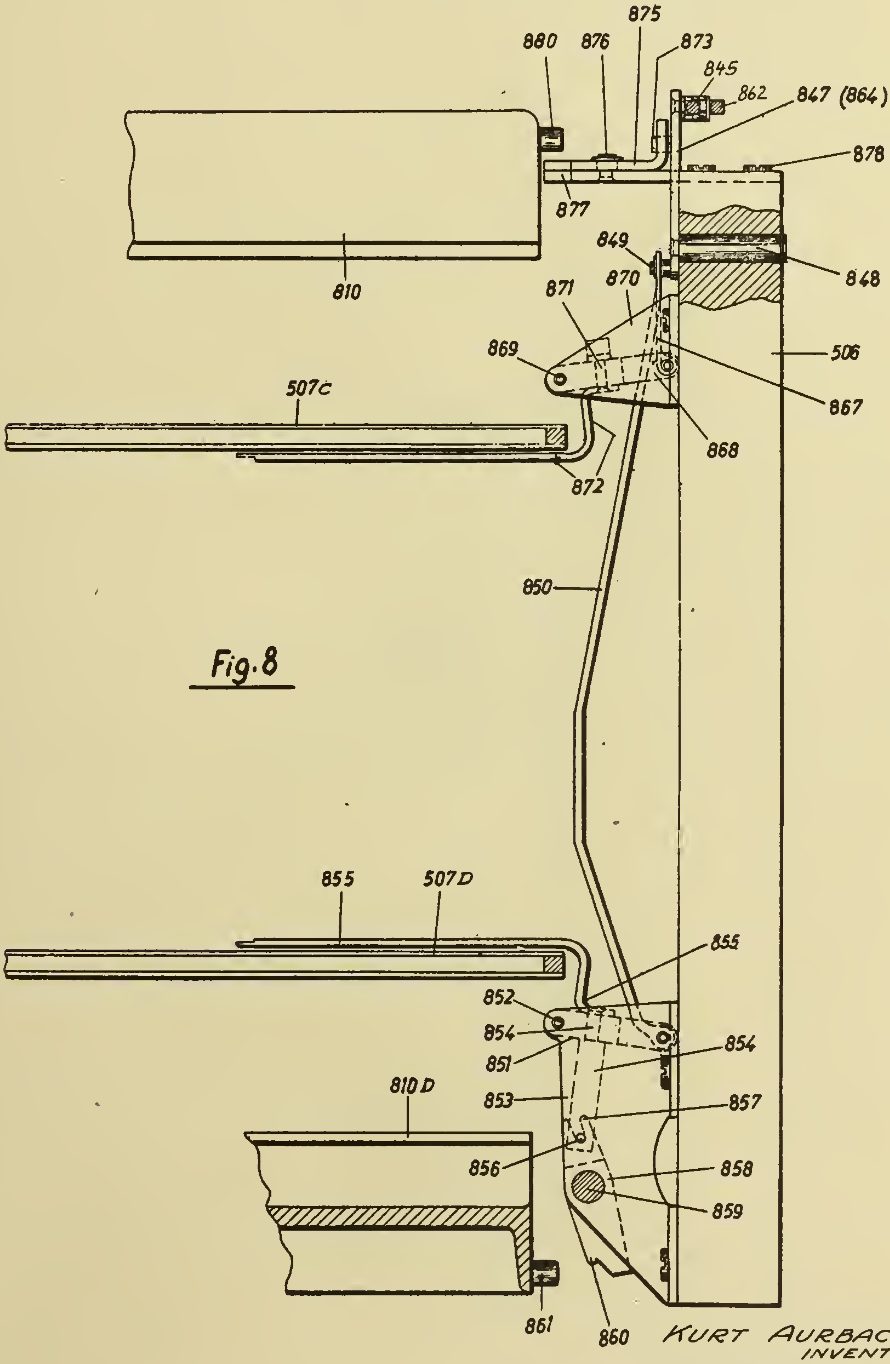

Fig. 8

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Fig. 9

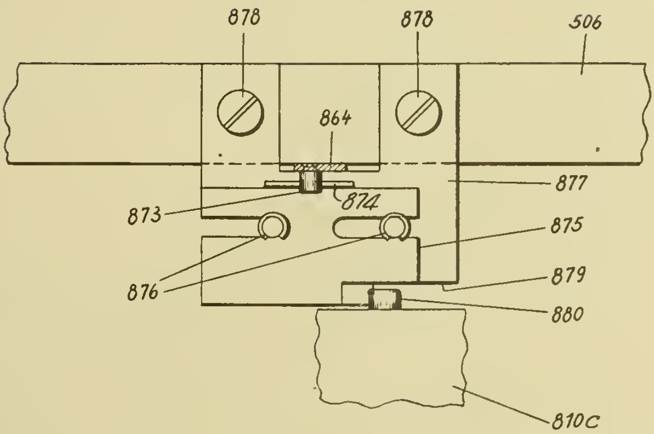

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Fig. 10

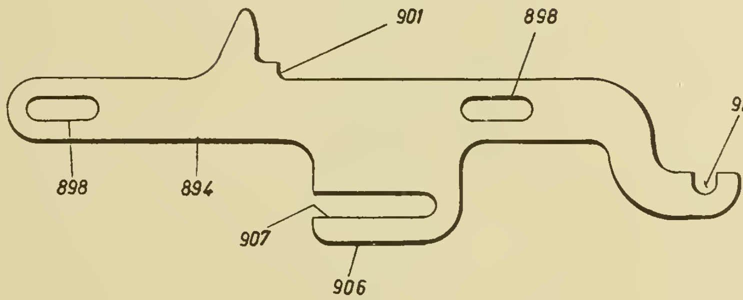

Fig. 11

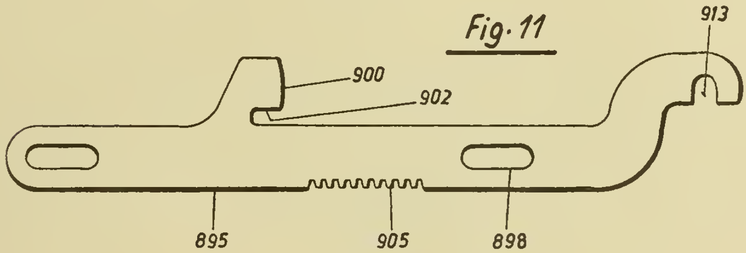

Fig. 12

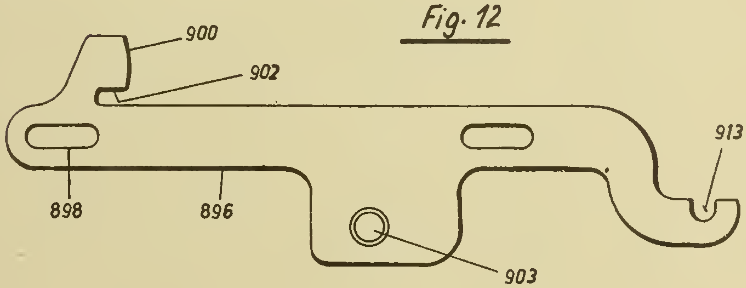

Fig. 13

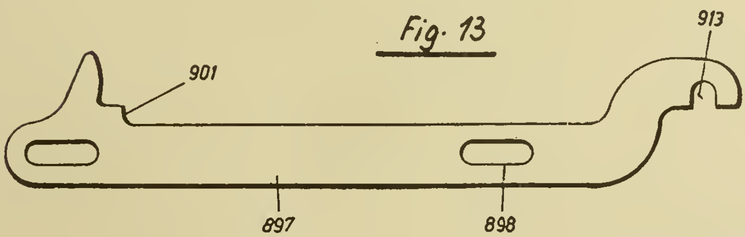

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Fig. 14.

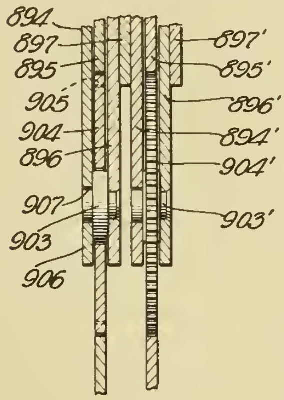
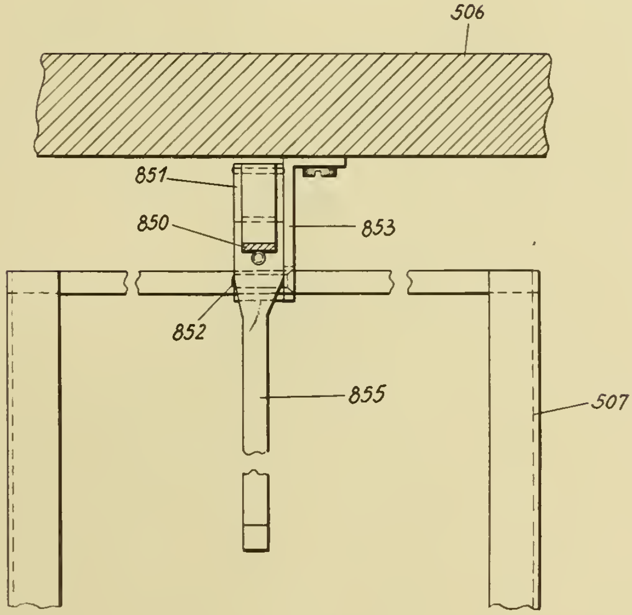


Fig. 15.



KURT AURBACH
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Fig. 16.

Fig. 16a.

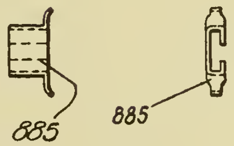

Fig. 17

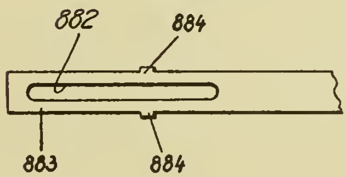

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Fig. 18.

Account Card.

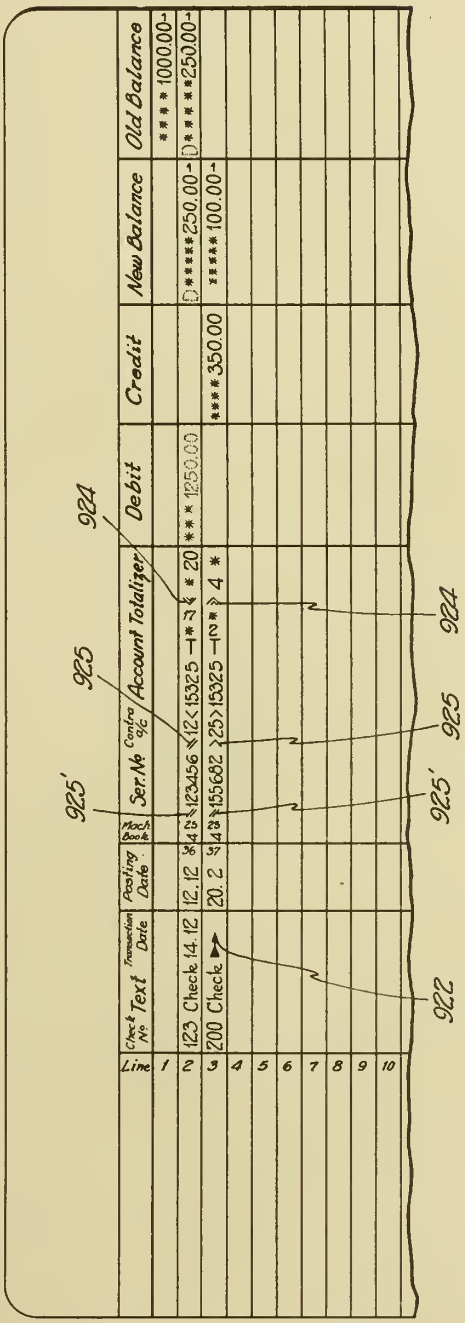

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Fig. 19.

Contra Account Card

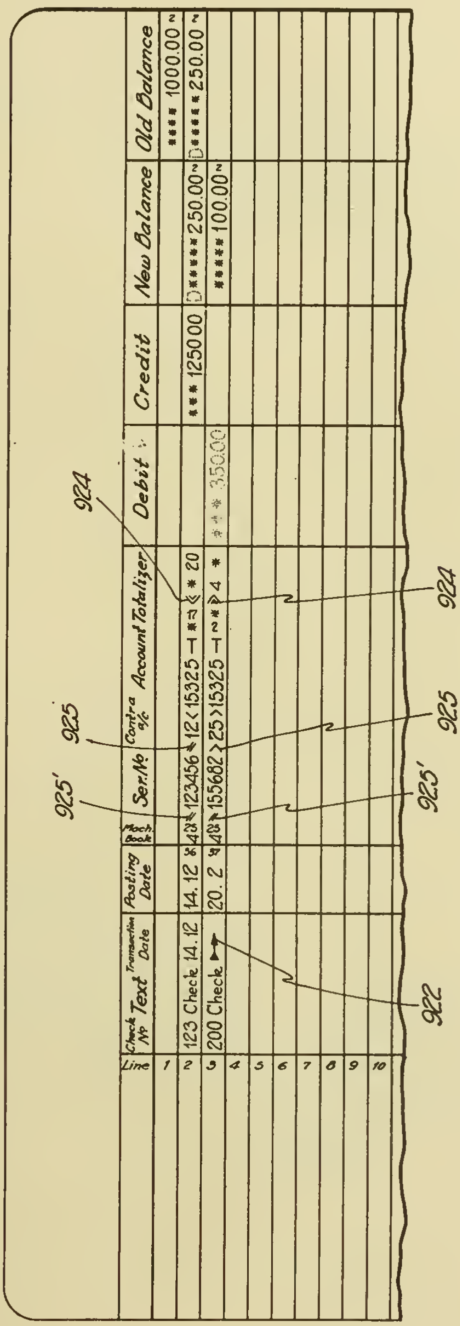

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Fig. 20.

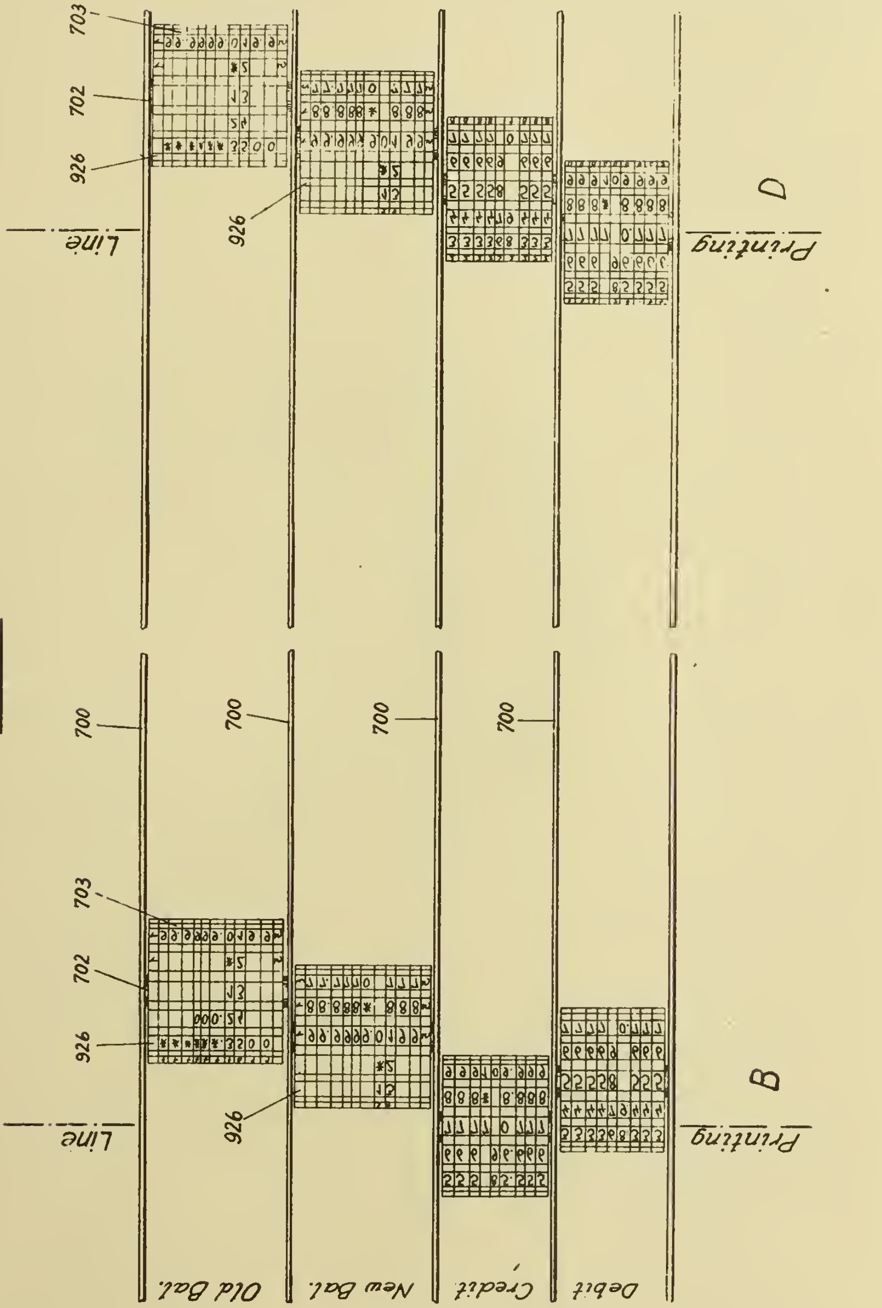

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Fig. 21.

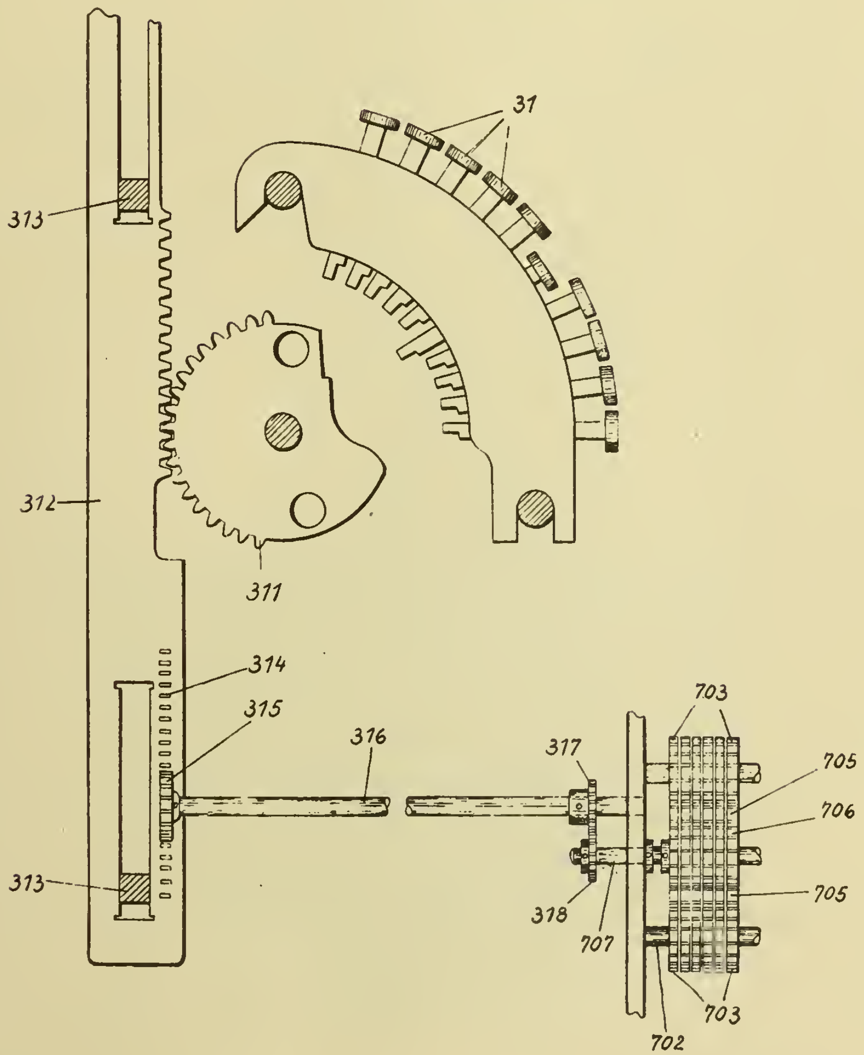

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Fig. 22.

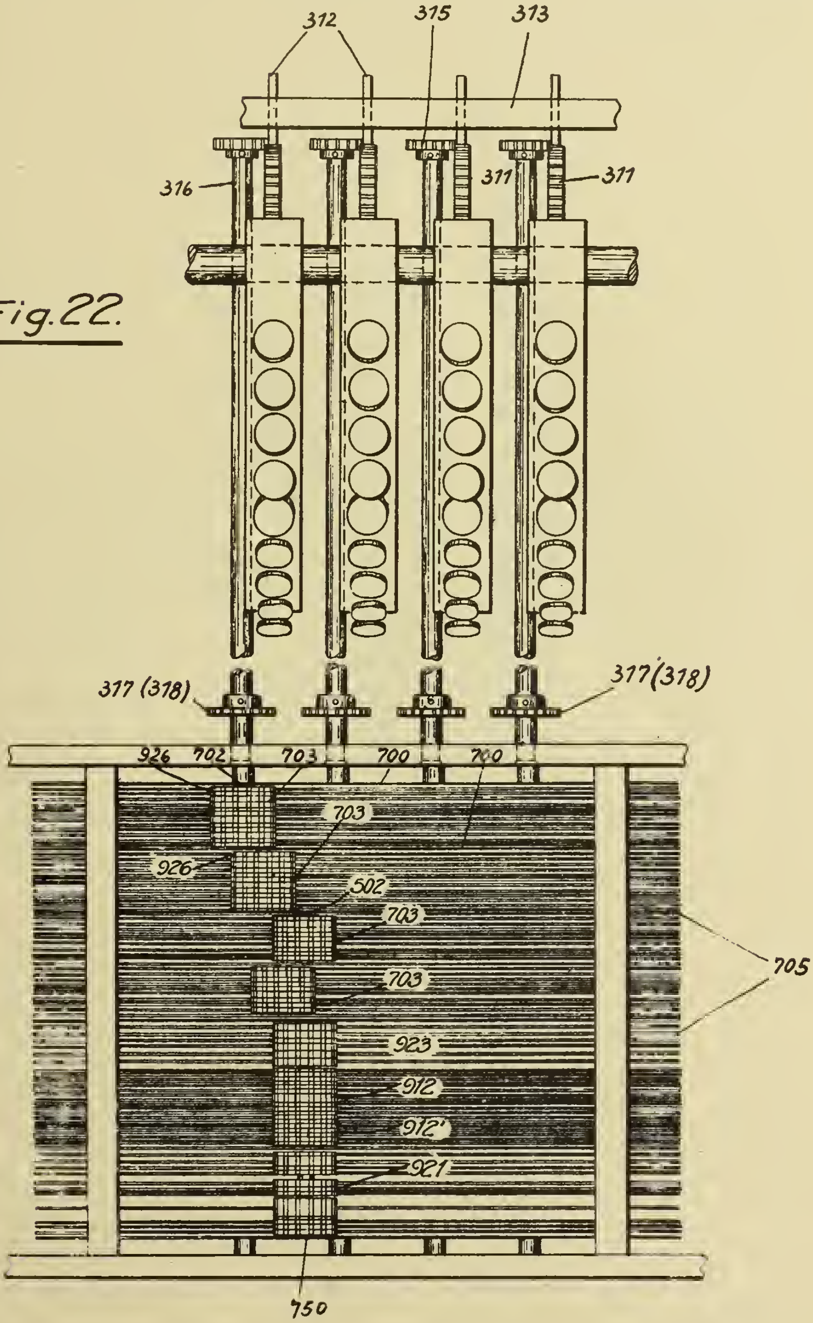

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Fig. 23.

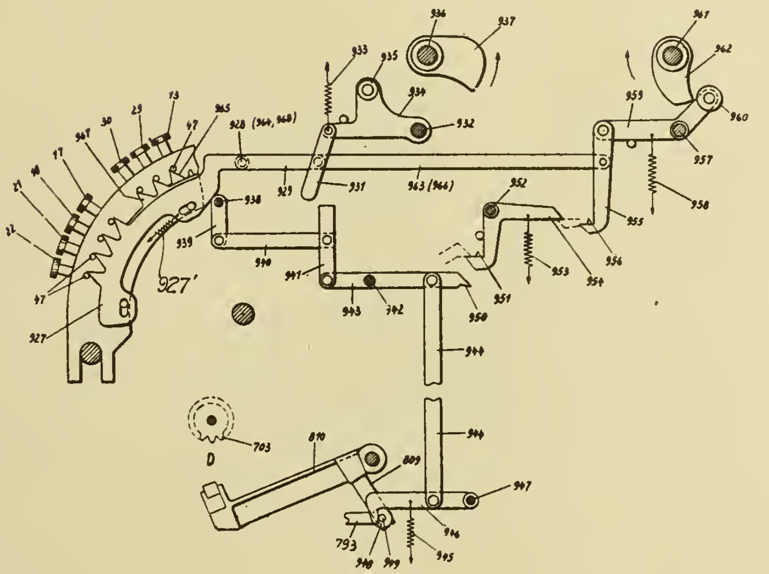

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Fig. 24

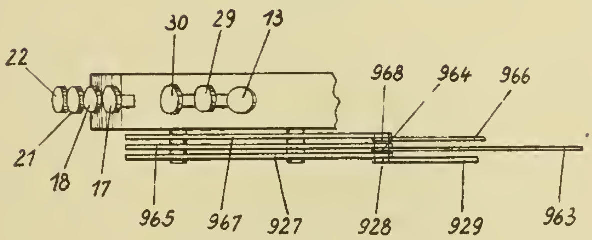

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Fig. 25.

Printing Diagram					
Kind of Operation Setting Keys	Printing Place: Book A	Account Card B	Receipt C	Contra % Card D	Control Strip. E
Old and New Balance I ACI; (KEY 15) ADI; (KEY 16) DACI; (KEY 19) DADI; (KEY 20) NCI; (KEY 1[illegible]) NDI (KEY 12)	Print	Print	Print	No Print	Print
Debits 1-22 Credits 1-22	Print	Print	Print	No Print	Print
End - Total (KEY 30) Sub - Total (KEY 29)	No Print	No Print	No Print	Print	Print

Fig. 26.

Printing Diagram					
Kind of Operation Setting Keys	Printing Place: Book A	Account Card B	Receipt C	Contra % Card D	Control Card E
Old and New Balance I ACI; (KEY 15) ADI; (KEY 16) DACI; (KEY 19) DADI; (KEY 20) NCI; (KEY 1[illegible]) NDI (KEY 12)	Print	Print	Print	No Print	Print
Old and New Balance II ACII; ADII; DACII; DADII; NCII; NDII;	No Print	No Print	No Print	Print	Print
Debits 1-22 Credits 1-22	Print	Print	Print	Print	Print
End - Total (KEY 30) Sub - Total (KEY 29)	No Print	No Print	No Print	Print	Print

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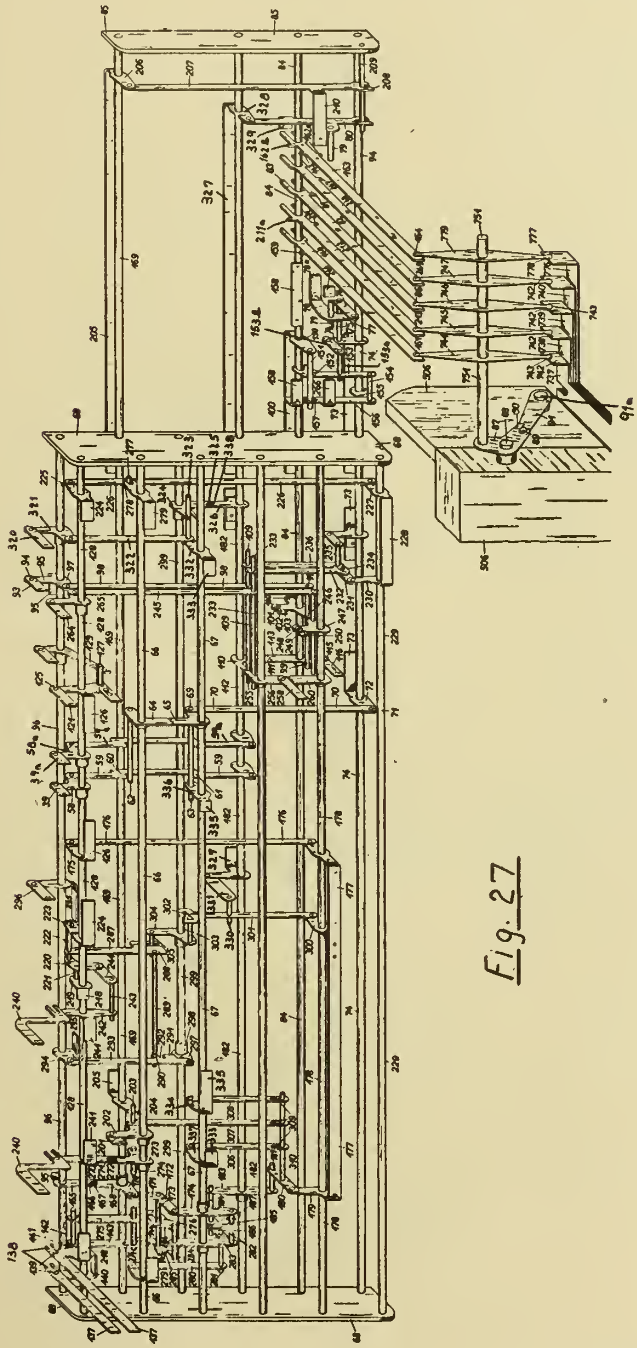

Fig. 27

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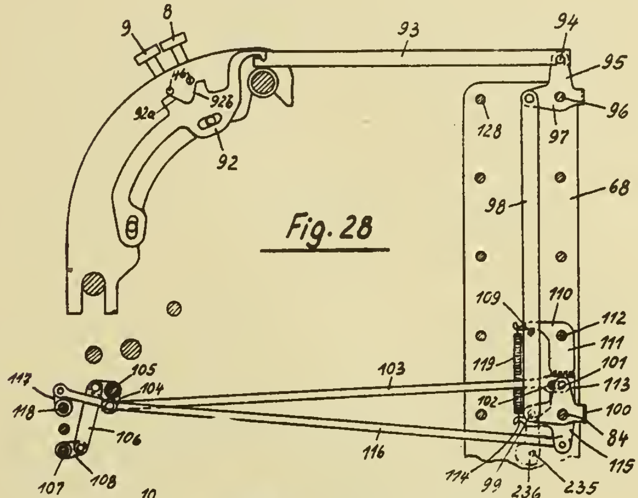

Fig. 28

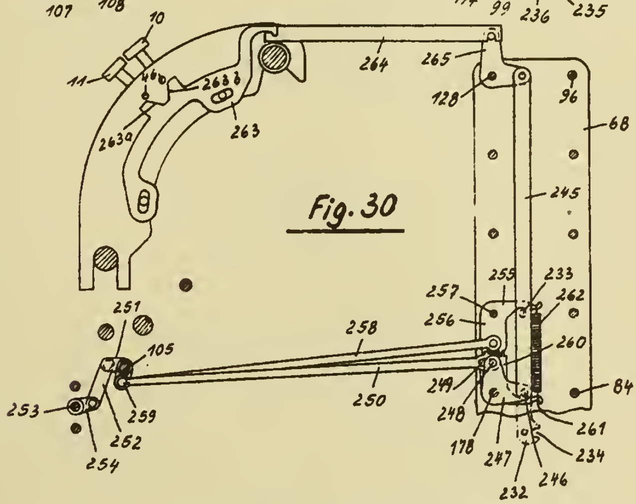

Fig. 30

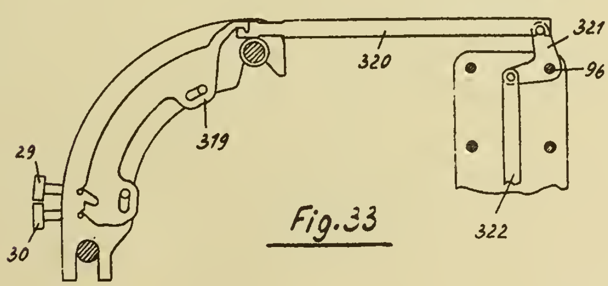

Fig. 33

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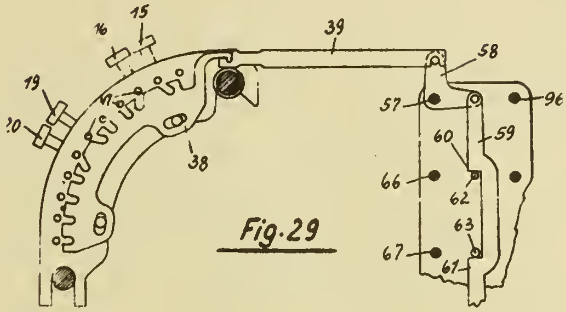

Fig. 29

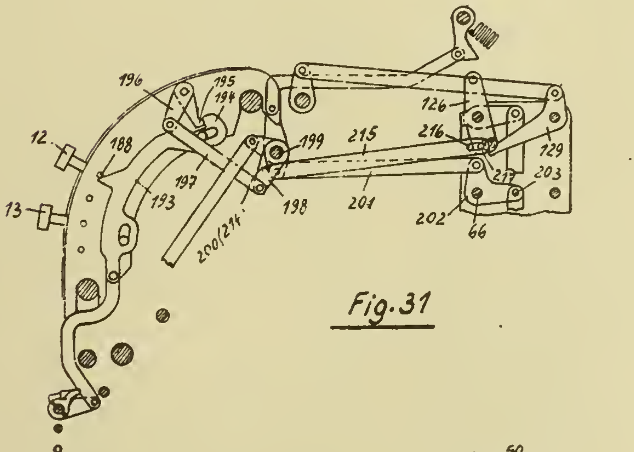

Fig. 31

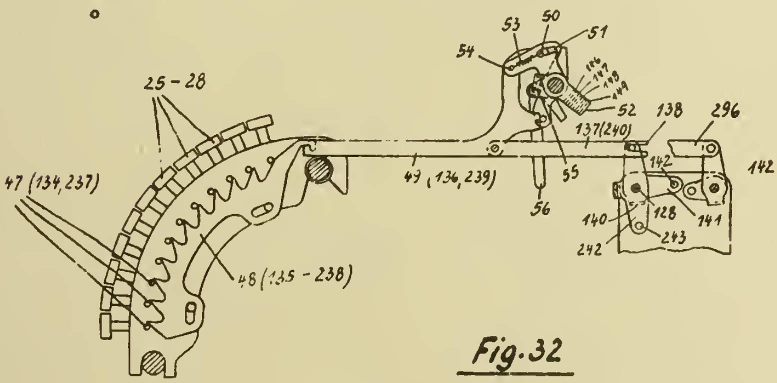

Fig. 32

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Published May 4, 1943 Serial No. 229,716

ALIEN PROPERTY CUSTODIAN

METHOD FOR PREVENTING THE DISAGREEABLE ODOUR OCCURRING IN THE COOKING OF SEA FISH

Franz Siegfried Falticzek, Vienna, Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 13, 1938

It is generally known that sea fish, in spite of their high nutritive value and their relatively low price, are not used as food by the whole population because only few people can stand the disagreeable odour produced at the preparation of the fish (boiling, frying, baking) and which is also present in the prepared food.

The method according to the invention has for its object to overcome this objection, that is the development of the disagreeable odour, and to considerably improve the aroma and taste of the fish and the nutritive value thereof. The method according to the invention consists in that fruit pulp or a concentrate, distillate or dry product obtained from fruit, by which the disagreeable odour appears to disappear entirely, is added to the fish during the cooking. According to another feature of the invention vegetable pulp, some vegetable concentrate or extract may be used in addition to the fruit pulp, tomato pulp with the fruit pulp which is always used having been found to be particularly suitable. Furthermore, the method according to the invention may be applied to give a certain aroma to the prepared fish by the additional of a small quantity of citric acid which imparts a certain spice to the prepared fish. The proportion of the fruit pulp (pulp, concentrate, distillate, dry product) to the vegetable substance, used in carrying out the invention may be from 15:1 to 5:1, but is preferably 10:1. For producing the fruit pulp used for carrying out the invention, cleaned fruits, such as pears, apples, apricots or the like, are boiled and then the fruit flesh (fruit pulp) is obtained therefrom. The tomato pulp may be added to this fruit pulp still in aqueous state in a proportion of about 1:10. After the mixture thus obtained has, if desired, been flavoured by the addition of a small quantity of citric acid and in some case essence of lemon, the mass is evaporated to a fraction of its former volume. Hereupon the preparation obtained is decanted and evaporated, and is then ready for use in the method according to the invention.

In carrying out the method according to the invention a suitable quantity of the preparation obtained in the manner described, or only the fruit pulp alone is stirred before commencing the cooking of the fish, into the still cold oil mostly used for frying and baking or into the water used for boiling. When the oil or water thus prepared has been heated to boiling point the fish is introduced and cooked in the usual manner. Care must be taken that the oil or water covers the fish in the pan or kettle and does not splash out during the cooking process. The method can also be carried out by stirring the fruit pulp or the other additions into the egg diluted with a small quantity of water and used for dressing with bread-crumbs, whereupon the washed and well salted fish is dressed in the usual manner in flour, egg and bread-crumbs and cooked floating in good table oil; when frying the fruit pulp and also the other additions can be stirred in a small quantity of water instead of being introduced into the cold oil in the manner above described, the fish being then drawn through this solution, if desired rolled in flour and bread-crumbs and fried quickly in good table oil. It is emphasized that the use of fruit pulp or of a fruit concentration, fruit distillate or dry product alone suffices for eliminating the objectionable odour and this simple addition is used in the same manner as the admixture composed of fruit and vegetables. It is evident that all other kinds of vegetables or additional admixtures can be used besides tomatoes, either in the form of a concentrate or of an extract.

By using the method according to the invention the known objectionable fish smell is not noticeable at all, whereas the aroma and taste of the fish are considerably improved.

FRANZ SIEGFRIED FALTICZEK.

Published May 4, 1943 Serial No. 230,336

ALIEN PROPERTY CUSTODIAN

PROCESS OF PROTECTING INACCESSIBLE SURFACES AND COMPOSITION THEREFOR

Eugene Hutzenlaub and Bernhard W. Muller, Stuttgart, Germany; vested in the Alien Property Custodian

No Drawing. Application filed September 16, 1938

It is known to provide interior inaccessible walls (e. g. of gasometers) with a coating, e. g. by blowing in a coating medium in atomized form, with the aid of compressed gases, whereby the atomized drops deposit upon the said interior walls. In a similar manner tubular conducting means for gas (pipes, gas mains etc.) were provided with an oil coating by atomizing an oil.

As the basis of the present case, we have discovered that oil coatings as well as films of non-drying or slowly drying coating media can be produced in tubular conducting means in a simple and certain manner by pouring the coating media into the tubular conducting means. It is sufficient if the medium at times (occasionally) covers the bottom part of the conductor, if one chooses coating media which possess a great wetting and creeping capacity (i. e. high capillarity) and therefore climb up on the walls of the conductors (pipes), so that they finally cover the whole of their inner surface, such for example, as high boiling mineral oils and their solutions. The climbing up and further creeping of the medium is accelerated by means of layers with capillary spaces likely to be found upon the inner surfaces of the tubes, for example roughness, rust or flue dust (or fume) layers. If the pipes (or tubes) are constructed (or laid) with inclined portions, one appropriately permits the coating medium to flow in at the highest point, so that it wanders to the lowest (or deepest) places, where, if necessary, any excess can be withdrawn for re-use. In the case of conduits for gas, the excess, for example, can be withdrawn out of the water trap. In case of necessity, the pouring in of the medium can be performed two or more times.

The new process can serve various purposes. If a rust preventive medium is employed, for example oil or a solution of bitumen in high boiling petroleum or tar oil, a rust preventing film is produced, which at the places of connection (joints) and the places where welding has been performed, is of particular importance, since, as is known, a rust preventive coating applied to them before setting up (or installing) of the pipe, is broken down or destroyed in the production of the joint and then ordinarily can not be renewed (replaced) inside by an ordinary subsequent coating, being inaccessible.

Frequently an interior protection of pipe systems is necessary on account of liability to change in composition of the gases being conducted. For example, the danger of rusting in gas conductors is strongly increased by the recent frequent removal of benzol from the illuminating gas. In such and similar instances the new process provides a welcome possibility to coat an old pipe system (or network) interiorly with a reliable rust preventing film.

In conductors fed with dry gases there is frequently formed burdensome flue dust or flue rust. This can be bound or made harmless by the new process by the use of oil or oil with the addition of bitumen, resin, artificial resin or the like.

Leaks, especially in the sleeve joints or due to porosity of the conduit walls, can be effectually combatted by pouring a coating medium into the conduits. Dried out and shrunken sleeve packings fill themselves with the medium by absorption, and thereby give gas-tight joints. The pores and the canals, which make possible the escape of gas, are made to disappear or are stopped up by being filled with the coating agent.

In the stated uses a sticking, binding action (adhesiveness or stickiness) of the employed medium can be of advantage. This action or property can be increased by the addition of bitumen, resins, or artificial resin to the said oils, or by the use of polymerizing oils such as anthracene oil.

Sometimes it can be advantageous to introduce the coating medium in the form of an emulsion, for example if the interior surfaces are moist (e. g. wet with water), or if for other reasons a water content of the medium is desired.

This effect may also be used for removing water from water-wet pipe interiors, by using oil carrying therein an emulsifying agent, so that when the oil in excess, carrying such emulsifying agent (the latter being water-soluble, and oil-soluble or oil-insoluble) is applied to or reaches parts of the interior of the pipe that are wet with water, the oil and emulsifier form an emulsion with the water in the pipe. Such emulsion can be of the oil-in-water type or water-in-oil type. This prevents rusting by removing the water and/or by converting the water into an emulsion, leaving the pipes covered with an oily composition.

Many films, for example those of or containing mineral oil pitch (asphalt), can also be used to precipitate gum-resins from the gas, whereby the resins do not foul the valves of the gas burners. Also for precipitating other constituents from the gas, for example for after purification (subsequent purification), the coatings find application.

For more fully explaining the nature of the invention, and how the same is to be performed, we give in an illustrating and non-limiting sense, the following examples of oils and mixtures suitable for use in the invention, without of course limiting the invention to these specific examples.

Examples

1. Tar oil of a specific gravity of 1.0 and a boiling range of 250–350°C from which anthracene has been removed by cooling.

2. In 70 parts by weight of tar oil of a specific gravity of 1.0 and a boiling range of 250–350°C, 30 parts by weight of natural resin (colophonium) are dissolved while heating the tar oil to 100°C.

3. 75 parts by weight of tar oil of a specific gravity of 0,96 and a boiling range of 200–300°C are heated to 100°C. Then, while stirring, 25 parts by weight of artificial resin of the type of phenolformaldehyd are dissolved.

4. 20 parts by weight of petroleum asphalt of a melting point (R. & B.) of 70°C are melted, to which, while stirring, 80 parts by weight of tar oil with a specific gravity of 0.96 and a boiling range of 200–300°C are slowly added.

5. 90 parts by weight of tar oil of a specific gravity of 1.0 and a boiling range of 250–350°C are mixed with 10 parts by weight of purified tar oil from which phenol has been removed, with a boiling range of 150–180°C while stirring.

6. 65 parts by weight of tar oil of a specific gravity of 1.0 and a boiling range of 250–350°C are mixed with 15 parts by weight of purified tar oil of a boiling range of 150–180°C, and heated to 100°C. In this heated oil mixture, 20 parts by weight of natural resin (colophonium) are dissolved while stirring.

7. 70 parts by weight of tar oil of a specific gravity of 0.96 and a boiling range of 200–300°C are mixed with 10 parts by weight of tar oil with a boiling range of 150–180°C. The oil mixture is heated to 100°C and mixed with 20 parts by weight of ratificial resin of the type of phenolformaldehyd, whereby the resin is dissolved in the oil.

8. 20 parts by weight of petroleum asphalt with a melting point of 70°C (R. & B.) are melted and, while stirring, a mixture is added consisting of 70 parts by weight of tar oil with a specific gravity of 0.96 and a boiling range of 200–300°C, and 10 parts by weight of white spirit with a boiling range of 140–170°C.

9. Refined mineral oil (spindle oil) with a specific gravity of 0.89, with a boiling point of more than 300°C.

10. 15 parts by weight of melted natural resin (copal soluble in oil) is, in melted condition, dissolved with 85 parts by weight of refined mineral oil of a specific gravity of 0.89 and a boiling point of more than 300°C.

11. 75 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89, and a boiling point of more than 300°C is heated to 100 C. In this heated oil 25 parts by weight of artificial resin of the type of phenolformaldehyd modified with fatty acid are dissolved while stirring.

12. 20 parts by weight of petroleum asphalt (high vacuum bitumen) with a melting point of 90°C (R. & B.) are melted and mixed with 80 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89 and a boiling point of more than 300°C heated to 100°C.

13. 80 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89 and a boiling point of more than 300°C are mixed with 20 parts by weight of white spirit with a boiling range of 140–170°C while stirring.

14. 75 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89 and a boiling point of more than 300°C are mixed with 10 parts by weight of white spirit with a boiling range of 140–170°C and heated to 100°C. To this heated oil mixture 15 parts by weight of natural resin (copal soluble in oil) is added, after melting and, stirred whereby the resin is dissolved in the oil mixture.

15. 20 parts by weight of artificial resin (cumar, indene) with a melting point of 60°C are dissolved in a mixture of 65 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89 and a melting point of more than 300°C, and 15 parts by weight of xylol.

16. 15 parts by weight of gilsonite asphalt are melted, and a mixture is slowly added of 75 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89 and a boiling point of more than 300°C and of 10 parts by weight of methylene chloride, whereby an even solution results.

17. 50 parts by weight of tar oil, from which anthracene has been removed with a specific gravity of 1.0 and a boiling range of 250–350°C are emulsified with 3 parts by weight of oleate of sodium and 47 parts by weight of water heated to 90°C in a high speed agitator in the wellknown manner whereby the water forms the continuous phase.

18. 15 parts by weight of petroleum asphalt (high vacuum bitumen) with a melting point of 70°C (R. & B.) are dissolved in 45 parts by weight of tar oil with a specific gravity of 1.0 and a boiling range of 250–350°C. The solution is emulsified in the known manner in a colloid mill with 36.5 parts by weight of water heated to 90°C and 3.5 parts by weight of sulphite liquor used as an emulsifying agent. In this, emulsion water forms the continuous phase, while the asphalt oil solution forms the dispersed phase.

19. 95 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89 and a boiling point of 300°C are mixed with 5 parts by weight of an ester of fatty alcohol. When this mixture is poured into moist conduits or when it is mixed with water while stirring, an emulsion forms whereby the water represents the continuous phase. The mixing with water is possible in any proportion.

20. 30 parts by weight of petroleum asphalt with a melting point of 40°C (R. & B.) are dissolved in a mixture of 55 parts by weight of refined mineral oil (spindle oil) with a specific gravity of 0.89 and a boiling point of more than 300°C and 10 parts by weight of white spirit with a boiling range of 140–170°C. To this solution, 5 parts by weight of an ester of fatty alcohol is added under stirring whereby a product results which can be emulsified with water in any proportion.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR SPREADING RUST PREVENTING MEDIA UPON THE INSIDE OF GAS HOLDER BELLS AND APPARATUS THEREFOR

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Application filed September 28, 1938

Gas holders in which a bell filled with a gas is closed at the bottom by means of a water seal are subjected in a high degree to the risk of rusting, and ,therefore, need careful rust protection. Since it is very troublesome and can cause considerable operating loss when a gas holder must be placed out of operation, it was not formerly as a rule possible to renew with rust preventing coating the entire inner side of the gas holder bell, which from the moisture in the gas is especially strongly exposed to rusting. If leaks occur at the seams or rivets between the several sheets from ruts or deterioration of the packing strips, then gas losses arise by way of the covering or bell, which can become important in extent.

By the following described process and apparatus a rotatory spraying apparatus with one or more nozzles is introduced through a slide valve or short piece of tube attached to the gas holder bell and communicating with the interior of the bell, through which apparatus the rust preventing liquid can be applied to the inner surfaces of the bell even during the use or operation of the gas holder.

In the drawings forming part of this description of the invention, four modifications of apparatus embodying the invention are illustrated. In these drawings

Figure 1 illustrates a gas holder or reservoir with the usual bell, provided, according to the invention with a spraying tube which is bent at an angle and which is provided with a jet or nozzle.

Figure 2 illustrates another modification of the invention with a hinged or jointed spraying apparatus applied to a gas holder or reservoir, said spraying apparatus comprising a movable spraying nozzle.

Figures 3 and 4 illustrate respectively two other forms of the invention having jointed or hinged spraying apparatus with spraying nozzle in fixed position in the spraying apparatus.

The gas holder or reservoir bell to be coated within its interior with a rust preventing liquid is designated in Figures 1 to 4 inclusive by the numeral 1. In Figures 1 to 4 are also shown the rafters 2, which carry the sheet metal covering, the slide valve 3 upon the bell or movable part of the gas holder, and the inlet tube or pipe 4 for the rust preventing liquid or liquid composition.

Figure 1 shows the slide valve 3 in open position and a tube or pipe 5 introduced therethrough into the bell or top of the gas holder. The tube 5 is bent at or near its end at an angle in such a manner that rust preventing liquid issuing therefrom will be directed towards and upon the interior walls of the bell 1. The rust preventing liquid is pumped under suitable pressure through the pipe 5 from the inlet pipe 4. By rotating the tube 5 by means of the handle 6 thereon the rust preventing liquid or liquid composition is uniformly distributed upon the interior surfaces of the bell 1. By lowering or raising of the tube 5, which is attained by suitable shifting of the ring 7, the range of the liquid jets is positively regulated. For treating of the entire inner surface of the bell 1 a plurality of tubes 5, 5', 5'', 5''', etc., with bent portions of different radii of curvature are used. The depth to which the apparatus is lowered or the position of the apparatus on turning is indicated upon the graduations or scale 8 or by the pointer 9.

If rust preventing liquid is pumped through the tube 4, it passes through the spraying tube 5 or 5', 5''. 5''' etc., and by rotation of the tube by means of the handle 6 is distributed upon the inner surface of the bell 1.

The introduction of the tube 5 or 5' etc., through the slide valve 3 is possible in spite of the curvatures of the tube because the height of structure of the valve 3 is small and its clear interior width is relatively large.

An excessive escape of gas through the valve 3 upon introduction of the tube 5, 10 or 12 is prevented by a divided and elastic packing collar or sleeve of known construction placed upon the tube.

In the case of large gas holders, in order to give the spraying apparatus a large radius of action, there can be employed, instead of the rigid bent tube 5, the apparatus described below and illustrated in Figure 2.

This apparatus consists essentially of the rocking boom 10 with hinge or pivotal connection 11 on the rotatable column 12 which is suspended from the towerlike superstructure 13 resting upon the container bell 1.

By means of the pivotal connection 11 and the steel-wire ropes or cables 14 and 14' the boom 10 can be placed in any position from a vertical position directly below the column 12, in which position the boom 10 and the column 12 are introduced into the gas holder, to almost a vertical position above the lower end of the column 12, as shown in broken lines in Figure 2. The adjustment of the boom 10 is effected by means of cables 14 and 14' wound upon a winch 15 of usual construction. The winch 15 is attached on the end of the part of the rotatable column 12 which

projects out of the container. The wheeling around of the boom 10 takes place by a suitable known driving gear, the wheel 16 of which sits slidingly on the rotatable column 12 and the worm 17 of which is fast upon the bearing column 18 screwed to the gas holder bell. Owing to the wheel 16 of the driving gear being slidably attached upon the column 12, the lowering or raising of the apparatus in the working position is rendered possible by means of the block and tackle 19 suspended on the towerlike superstructure 13.

The boom 10 serves for the reception of a sliding carriage 20 movable longitudinally thereof in track 21, said carriage being provided with a spraying nozzle 25. The carriage 20 can be moved from the middle to the ends of the boom 10 or inversely by an endless towing line 22 which passes over the guiding roller 23 and roller 23', and rising in the column 12 is wound upon or off of a drum 24.

The free end of the boom 10 is so formed that the sliding carriage 20 can be tilted from a horizontal to a vertical position, whereby the device may also be used to spray the vertical walls. The position of the sliding carriage 20, the inclination of the boom 10 and its position upon rotation, as well as the depth of the apparatus are indicated in known manner by apparatus corresponding to the object in view.

By this regulation of the different movements an exact, uniform and economical distribution of the rust preventing agent in all corners and joints of the bell 1 and of the rafters 2 is effected. The supply of the working material to the nozzle 25 built in the sliding carriage 20 takes place through a flexible pipe or hose 26 situated on the boom 10 between the sliding carriage tracks 21. This hose extends upwardly in the column 12, connecting with the inlet pipe 4, and contains enough slack to follow the motion of the carriage 20 to the free end of the boom 10.

By means of the guys 27 the stability of the superstructure 13 and of the whole apparatus is made certain.

In order not to call excessively upon the covering 1 of the gas holder, the load of the superstructure 13 and of the apparatus proper is distributed uniformly by a stiff carrying frame 28 upon the rafters 2 of the bell 1.

A further possibility of the modification of the spraying apparatus illustrated in Figure 2 is shown in Figure 3. Instead of a boom 10 for receiving a movable nozzle 25 there is a tube 29 along the length of which at certain distances several nozzles 30, 30', 30'' etc., are built in, which can be set in operation either all simultaneously, according to Figure 3, or in groups of 2 or 3 of the row as illustrated in Figure 4. In the case of simultaneous connection of all the nozzles 30, 30' etc., the working material is lead to them through the interior of the tube 29, which is connected with the inlet pipe 4 by a hose 31 rising in the columns 12. In the case of connecting the nozzles in groups, as shown in Figure 4, as many small conducting tubes 32, 32' etc., are disposed inside of the boom 33 formed as a tube as there are groups of nozzles present. The connection between the individual conducting tubes 32, 32' etc., built in the boom 33, and the inlet pipe 4 outside of the container is established by as many hoses 34 and 34' etc., rising in the column 12 as there are conducting tubes 32, 32' etc., present. The tubular booms 29 and 33, shown respectively in Figures 3 and 4, are hinged or pivotally connected to the rotatable column 12 in the same manner as boom 10 in Figure 2 is connected to the column 12.

The mode of operation of the spraying apparatus illustrated in Figure 2 is as follows:

If the guiding tower 13 and the carrying frame 28 are erected upon the container bell 1, and the spraying apparatus with the aid of the block and tackle 19 suspended from the tower 13, either in folded up or extended condition, is introduced into the gas holder through the valve 3 and the bearing column 18, then the boom 10 is brought into working position by the winch 15 and the lines 14 and 14'. If the rust preventing liquid is pumped under pressure through the inlet pipe 4 and the hose 26 to the nozzle 25, which in its initial position is at the middle of the boom 10, then by simultaneous rotation of the column 12 the rust preventing material is distributed uniformly upon the inner surface of the container bell 1 in a circular ring surface. This process with displacement of the nozzle 25 is repeated until the roof as well as the cylindrical portion or vertical wall portion of the bell 1 is treated with a plurality of annular coatings lapping over one upon the other. By using the boom shown in Figures 3 and 4 the entire inner surface is treated in one or two operations.

Any of the known rust preventing liquids can be used for coating of the gas holder bells so long as they can be sprayed.

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PROCESS FOR SPREADING RUST PREVENTING MEDIA UPON THE INSIDE OF GAS HOLDER BELLS AND APPARATUS THEREFOR

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Serial No. 232,172

3 Sheets-Sheet 1

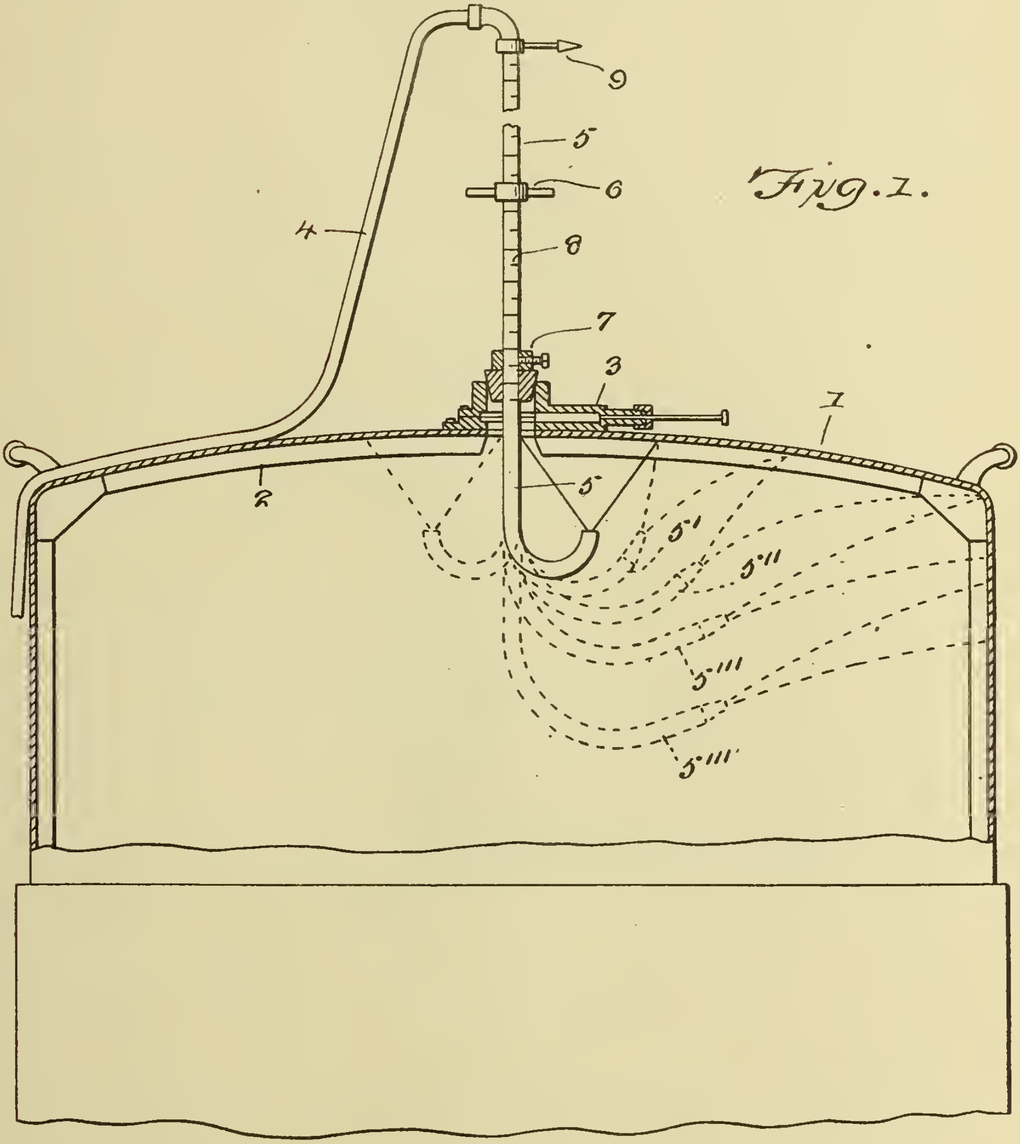

Fig. 1.

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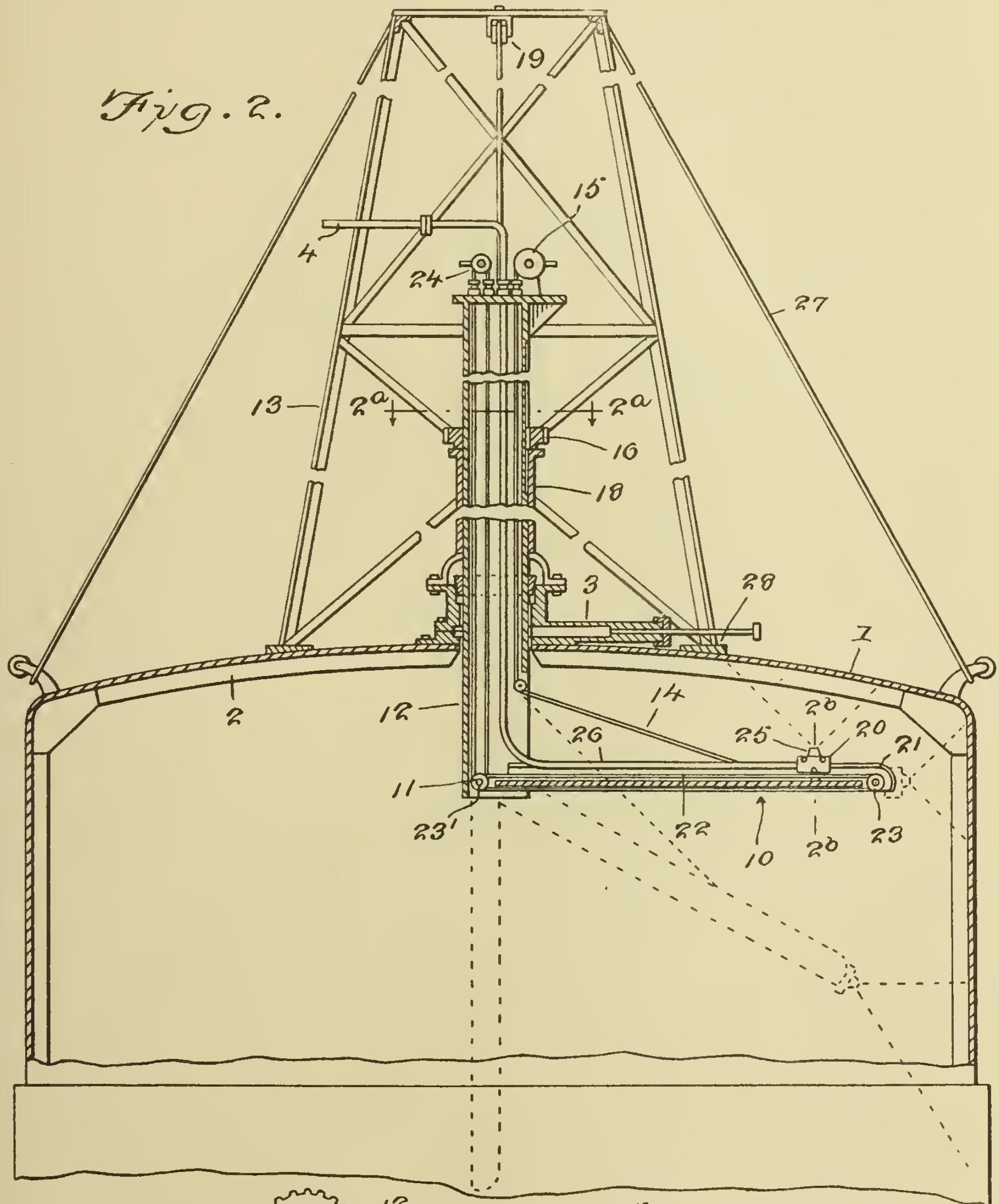
3 Sheets-Sheet 2

Fig. 2.



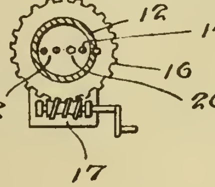


Fig. 2a.

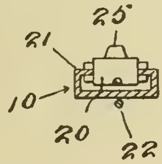


Fig. 2b.

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3 Sheets-Sheet 3

Fig. 3.

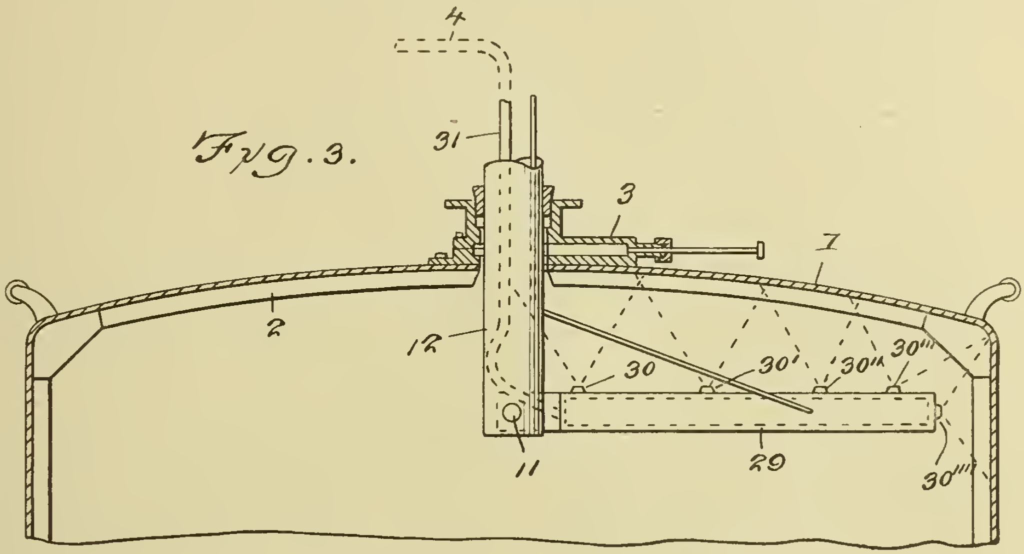
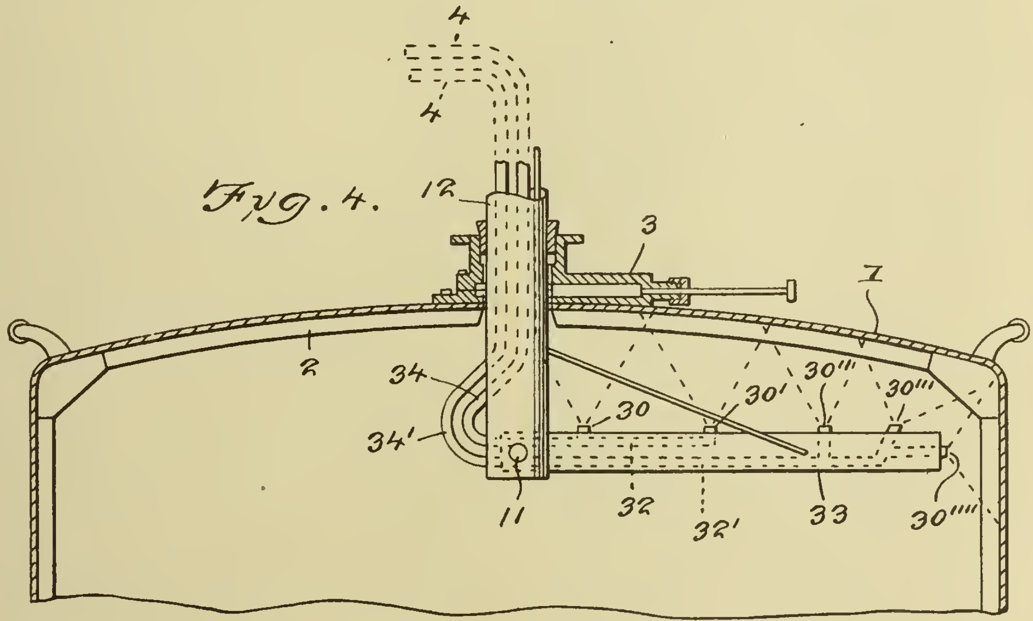


Fig. 4.



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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE IMPROVEMENT OF TEXTILES

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No Drawing. Application filed October 4, 1938

This invention relates to a process for the improvement of textiles.

It is known to increase the resistance to creasing of textiles and to reduce shrinking and tendency to swell, by applying artificial resins on to the fibres, these artificial resins being either condensation products, e. g., of phenols and formaldehyde or urea and formaldehyde, or polymerisation products, e. g., polyvinyl artificial resins.

With both processes, there is attained to a certain extent an improvement of the textiles, the resistance to creasing of the textiles being for example very considerably increased. Both known processes, that is, the application of condensation products and the application of polymerisation products are, however, accompanied by disadvantages, those in the case of condensation products consisting for example in the effect not being particularly resistant to washing, whilst sometimes there is damage to the fibres by the heat treatment of the textiles used when employing these condensation products. With the other process, that is, in the application of polymerisation products, the effect of resistance to creasing is not very good and frequently the tendency of the fabric treated to swell is not sufficienty reduced, so that the results attained by this process also leave something to be desired.

It has now been found according to this invention that the disadvantages of the known processes do not occur and advantages are attained if both artificial resin polymerisation products and also artificial resin condensation products are applied to the textiles to be treated. In any case, results are then attained which are better than if, under otherwise like conditions, only condensation products or only polymerisation products were applied. Such a combination effect was not to be expected according to the behaviour of the individual substances and it is surprising that these improved effects are attained by the combination according to the invention.

The resistance to creasing, for example, of the fabric treated according to the invention is always better than that of fabrics which have only been treated with the condensation resin or only with the polymerisation resin. Furthermore, in each case, the tendency to shrink and swell is reduced and a considerable improvement of the handle is attained and in particular when comparatively little resin, i. e., less than is necessary for resisting creasing is applied to the fibres. Furthermore, according to various conditions, special effects occur.

As condensation resins, there can be used for example those obtained from phenol and formaldehyde or from urea and formaldehyde. As polymerisation artificial resin substances those are for example suitable which are prepared from organic unsaturated compounds, such as styrol, acrolein, vinyl compounds and the like. These substances easily polymerise with moderate action of heat by the effect of light.

The textiles to be treated are, for example, saturated with phenol and formaldehyde, and also with styrol, whereupon by the action of heat the desired effect is produced.

In the saturation of the textiles with pre-condensates or aqueous solutions which contain the resin-forming components, the quantities of the resin applied to the fibre are below the concentrations hitherto used. The optimum quantity of the polymerisable compounds used in individual cases can easily be determined. By addition of catalysts or anti-catalysts, e. g. metal halides, per-compounds, acids or bases, the reaction can be controlled as desired.

Protective colloids or dispersion agents can be used.

A stable effect is attained by the action of heat.

Simultaneously with the treatment for attaining a resistance of the textiles to creasing and for obtaining products which have a low shrinking and swelling capacity, there can take place a treatment for attaining other effects. There can be, for example, attained simultaneously a weighting, increase of volume, increase of stiffness or stability, the attainment of a wool-like handle, the reduction of heat conductivity, resistance to water or fireproofing or impermeability to gases.

Examples

1. The fibre is saturated in a solution which contains phenol, formaldehyde, formic acid, polyvinyl alcohol, ammonium acetate and a protective colloid. Drying then takes place at 50–60° C. with condensation for a short time at higher temperatures of 80° C.

2. The fibres are saturated in a solution which contains a mixture of urea and thiourea, hexamethylene tetramine, common salt, ammonium acetate, tartaric acid and glyoxal. There then follows a thermal treatment.

3. There are added to the solutions employed according to Examples 1 or 2, tungstates, borophosphates and the like and a thermal treatment is also applied. In this way, washable and non-inflammable textiles are obtained.

4. The solutions according to Example 1, 2 or 3, are mixed with hydrophobic substances such for example as stearic acid anhydride and the like, whereby there is attained a water-resisting action with increased washability.

5. The textiles to be improved are saturated in a solution which contains 150 parts of dimethylol urea, 15 parts of polyvinyl alcohol, 8 parts of ammonium thiocyanate and an acid or an acid-yielding salt. On drying at 50–60° C. and condensing for 5–10 minutes at 130° C. there is attained in addition to the resistance to creasing, no shrinking and reduced swelling already mentioned, an improvement of the resistance to moisture, which amounts to over 50%.

6. The material is saturated in a solution which contains 200 gms. of dimethylol urea, 20 gms. of polyvinyl alcohol, 6 gms. of aluminium sulphate and 10 gms. of lactic acid. Drying then takes place in known manner and condensation and polymerisation with heating. In addition to resistance to creasing, no shrinking and reduced swelling, there is attained in addition to the improvement of the resistance to moisture, a finish similar in appearance to linen.

7. The material is saturated in a solution which contains 200 gms. of urea or thiourea, 650 gms. of 30% formaldehyde, 100 gms. of ammonium sulphite, 15 gms. of polyvinyl acetate and 15 gms. of 30° Be aluminium chloride solution. There is added as protective agent 7 gms. of glucose. Drying and ripening by heating takes place in known manner. The results thus attained such as resistance to creasing, no shrinking, reduced swelling, increased resistance to moisture, become much more valuable by the attainment of a particularly good wash-resisting linen-like handle of the material.

8. The material is saturated in a solution which contains 250 gms. of urea, 10 gms. of ammonium acetate, 120 gms. of formaldehyde, 10 gms. of acryl acid methyl ester, 4 gms. of sodium sulphocyanide, 15 gms. of glycol acid and a stable plasticiser, and is treated in known manner with heating. The goods obtain a stable agreeable woolly handle which in addition to the resistance to creasing, no shrinking, reduction of the swelling and increased resistance to moisture, represents an important improvement in quality.

9. The material is treated in a solution which contains 75–100 gms. of dimethyl urea, 8 gms. of polyvinyl alcohol, 20 gms. of thiourea, 12 gms. of paraformaldehyde, 10 gms. of glue, 8 gms. of ammonium thiocyanate, 4 gms. of aluminium chloride, and is subjected to a thermal ripening. In addition to the resistance to creasing, no shrinking, reduced swelling and increased resistance to moisture, there is attained a particularly good bundle elasticity, that is, an improvement in the resistance to standing and treading desired for many purposes, e. g. for carpet yarn.

10. The material is treated in a solution of 150 gms. of dimethyl urea, 50 gms. of phenol, 32 gms. of formaldehyde (30%), 10 gms. of diacetin, 8 gms. of polyvinyl acetate, 5 gms. of sodium metaphosphate, 5 gms. of boric acid and 0.2 gms. of hydrochloric acid. After condensation or polymerisation with heating, there is obtained a material which in addition to resisting creasing, not shrinking, resisting moisture and being only slightly subject to swelling, has also an increased heat retaining capacity.

11. The material is treated in a solution which contains 300 gms. of urea, 15 gms. of polyvinyl chloride, 5 gms. of aluminium sulphate, 3 gms. of tartaric acid and 10–15 gms. of a paraffin emulsion. After thermal treatment, there is obtained a material which has a slight tendency to creasing, does not shrink, has great resistance to moisture and in addition possesses good heat insulating properties and resistance to soiling.

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ALIEN PROPERTY CUSTODIAN

LIGHT METAL PISTONS

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Application filed October 5, 1938

In order to increase the life of pistons or to increase the output of the engine attempts have already been made to provide light metal pistons, that is pistons made of aluminum or magnesium alloys with metallic protecting layers. Attempts have been made to apply the protective metal by means of metal spraying pistols and by galvanic means. The metal coatings obtained in this way, however, do not meet the great demands put upon the piston during running since they have only slight adhering power and easily become detached from the base material during running whereby serious stoppages may be caused if the parts which have scaled off get between the sliding surfaces. With pistons consisting mainly of magnesium for example, it is impossible to apply protective layers galvanically. These drawbacks are avoided by the invention.

The invention relates to a light metal piston which is characterised by the feature that it is partly or wholly, and especially at the head of the piston, covered with a metallic protective layer, the basis of which is secured to the base material by diffusion or formation of alloy. The metallic protective layer may preferably have a thickness of from 0.005 up to a few millimetres. The application of the metallic layer is effected preferably by cathode disintegration with a filling gas pressure of 3-0.01 mm. mercury. The application of the metallic layer can also be effected by thermal evaporation at a filling gas pressure of $3\text{–}10^{-6}$ mm. The metal layer may consist of various metals according to requirements. Thus, for example, it is advantageous to apply to the piston head a protective layer of silver or copper to obtain better conduction and reflection of heat while, on the skirt of the piston, in order to improve the running properties, layers are applied which experience little wear during running or even have a lubricating effect. The metal layers applied according to the invention are far better than the hitherto known protective layers as regards adhering power and are able to stand up to the thermal and mechanical stresses during running.

The invention further relates to a light metal piston of aluminium, magnesium or aluminium or magnesium alloys for engines which is characterized by the feature that it is partly or wholly covered with one or more metal or metal alloy layers applied by cathode disintegration or thermal evaporation in vacuo. The metal or metal alloy layer applied by cathode disintegration or thermal evaporation in vacuo is preferably alloyed with the base material of the piston or partly or wholly diffused into the base metal. The metal piston is further characterized by the feature that the metal or metal alloy layer applied by cathode disintegration or thermal evaporation in vacuo is of a thickness of over $\frac{1}{1000}$ mm. preferably $\frac{5}{1000}$ to $\frac{5}{100}$ mm. up to 1 or more mm., is finely crystalline, of compact structure and strongly adherent.

The invention further relates to a method for making an engine piston of aluminium, magnesium or aluminium or magnesium alloys which is partly or wholly metallised on its surface and which is characterised by the feature that the covering material or the alloy is applied by means of cathode disintegration or thermal evaporation at reduced pressure or in vacuo. Also several metal layers may be applied successively by cathode disintegration or evaporation. The metallising of the light metal piston by cathode disintegration or evaporation is preferably carried out in a neutral or reducing atmosphere at pressures below 50 mm. mercury, preferably between 5 and 10^{-6} mm. mercury. It is particularly advantageous if the metal or metal alloy layer applied by cathode disintegration or evaporation is alloyed with, or diffused into, the piston, by the piston being heated to the alloying or diffusing temperature, preferably in the cathode disintegration or evaporation chamber itself, before, during or after the cathodic metallising or evaporation. The heating of the piston is preferably effected by means of a gas discharge before, or after, the cathode disintegration or evaporation, the temperature of the piston being adjusted by varying the discharge output or by altering the filling gas pressure. The piston is subjected to the gas discharge as a cathode, neutral or as anode. In the cathode disintegration only a fraction of the electrical energy supplied is utilised for disintegrating the cathode. The greater part is converted into heat at the cathode and in the gas space. The quantity disintegrated increases with the discharge power supplied, but at the same time also the heating of the cathode increases. It is thus preferable to cool the cathode in order that the greatest possible disintegrating power may be applied. The energy released in the gas space serves for heating the piston. In order to obtain uniform heating of the piston the cathode preferably surrounds the piston on all sides. The cathode thus preferably itself forms the disintegrating chamber or parts and is provided with a cooling jacket through which water flows. The output at the discharge path is restricted by the temperature to be imparted to the piston. It has

been found experimentally that the temperature of the piston can also be regulated by varying the pressure and the temperature is reduced by increasing the filling gas pressure and vice versa. By correctly choosing the pressure it is thus possible to obtain an optimum disintegration output in the discharge path, and to reduce the deposition time to a minimum. A suitable constructional form is therefore one in which the cathode forms the wall of the vessel which feeds power from the discharge to the article uniformly from all sides in order to obtain uniform heating, and is uniformly disintegrated.

According to the method of the invention any metals or alloys can be applied to the piston by the cathode disintegration or thermal evaporation in vacuo and parts which are not to be metallised are covered by a protective layer or a protecting member. The metal layer applied to the metal piston of aluminium, magnesium or aluminium or magnesium alloys by cathode disintegration or evaporation consists preferably of metals such as chrominum, molybdenum, tungsten, iron, cobalt, nickel, copper, silver, platinum, palladium, tin, lead, aluminium, rhodium, cadmium, zinc, vanadium, tantalum, zirconium or the like, separately or in any desired combination. If, for example, only the head of the piston is to be metallised, the side wall of the piston is covered by a protective sleeve or a suitably shaped disintegrating electrode is used. The layers applied by cathode disintegration or evaporation are found to adhere extremely strongly especially when in the alloyed-on state, so that a piston thus covered not only has a very high wear value, but also is protected against the attack of acid condensates from the combustion chamber. According to the melting point of the metal which it is desired to apply it is of advantage to interpose intermediate layers of other metals so that alloys of ternary or higher systems are formed which can be more easily alloyed-on than the pure metal and on to which, finally, the pure metal can be disintegrated or evaporated. The piston skirt is preferably coated with copper, nickel, iron or chromium by cathode disintegration or evaporation. It has been found that silver and nickel as well as chromium applied on the piston head by cathode disintegration or evaporation are good heat reflecting materials while, in the interior of the piston, in order to radiate heat, preferably copper is applied by cathode disintegration or evaporation, which after the conclusion of the disintegration or evaporation, may be oxidised by introducing oxygen into the cathode disintegration or evaporation chamber. If it is desired to have metals of high melting point at the surface it is particularly advantageous for anchoring the layer if intermediate layers are introduced which form alloys of lower melting point with the piston material and the metal of high melting point. The metals and the temperatures to be used depend upon the desired properties of the surface.

According to the method of the invention light metal pistons of any desired composition and construction of aluminium, magnesium or aluminium or magnesium alloys can easily be metallised as is shown by the following examples.

A light metal piston of the Nelson-Bohnalite type of 77.5 mm. diameter, for example, was coated on its surface by cathode disintegration with a layer of copper, the piston being coated at a temperature of about 450 to 550° C. Preferably at the beginning and at the end of the deposition the piston is brought for a short time to the diffusion temperature and in the intermediate time the metal is deposited upon the hot piston at a somewhat lower temperature. The deposition was carried out in hydrogen at a pressure of 3 mm. mercury. The disintegrating voltage was rectified alternating voltage the effective value of which was 700 volts with a disintegrating current of 7 amps.

Further a light metal piston made of alloy containing magnesium and of 77.5 mm. diameter was coated on its surface by cathode disintegration with a layer of silver, the metal piston being coated at a temperature of 450–500° C. Preferably at the beginning and at the end of the deposition the piston was for a short time brought to the diffusion temperature and in the intermediate time the metal is deposited on the hot piston at a somewhat lower temperature. The deposition is carried out in argon at a pressure of 1 mm. mercury. The disintegrating voltage was a rectified alternating voltage the effective value of which was 700 volts at a disintegrating current of 7 amps. The heating of the piston to the alloying or diffusing temperature was effected in both cases by gas discharge in the cathode disintegrating chamber. The copper or silver layer obtained in this manner was extremely firmly secured to the piston material.

Further, e. g., a light metal piston of the Nelson-Bohnalite type of 77.5 mm. diameter was coated on its surface with a layer of copper by thermal evaporation in vacuo the piston being kept by a temperature of about 450–550° C. Preferably at the beginning and at the end of the evaporation the piston was for a short time brought to the diffusion temperature and in the intermediate time the metal was evaporated on to the hot piston at a somewhat lower temperature. The evaporation was carried out in hydrogen at a pressure of 0.3 mm. mercury.

Finally a light metal piston of 77.5 mm. diameter made of an alloy containing magnesium was coated on its surface with a layer of silver by thermal evaporation in vacuo the piston being kept at a temperature of 450–550° C. Preferably at the beginning and at the end of the evaporation the piston was brought for a short time to the diffusion temperature and in the intermediate time the metal was evaporated on to the hot piston at a somewhat lower temperature. The evaporation was carried out in argon at a pressure of 0.01 mm. mercury. The heating of the piston to the alloying or diffusing temperature was effected in both cases by gas discharge in the evaporation chamber. The heating voltage was a rectified alternating voltage the effective value of which was 700 volts at a disintegrating current of 3 amps. The copper or silver layer obtained in this manner was extremely firmly secured to the piston material.

The invention further relates to an apparatus for carrying out the described method which is characterized by a cathode disintegrating chamber with a metallic lower part which can be cooled and a removable metallic upper part which can be cooled, of which the metallic wall forming the cathode consists of the metal to be deposited on the piston or is coated therewith. The metallising chamber has an anode which is led through the metallic wall of the chamber being insulated and screened. The metallising chamber is further characterised by a metallic lead-in which can be cooled and is insulated and screened, preferably in the lower part of the cathode disintegrating chamber on which the piston to be met-

allised is mounted by means of a conducting or insulating supporting plate.

The invention further relates to an apparatus for carrying out the described method which is characterised by a vacuum evaporating chamber with a metallic lower part which can be cooled and a removable metallic upper part which can be cooled the wall of which carries a metallic current lead-in which can be cooled and is insulated and screened and on which the piston to be metallised is arranged by means of a supporting device which conducts the electric current, and by an electrically heated crucible containing the metal to be evaporated underneath the piston, and also by a source of continuous or alternating voltage of which one, preferably the negative, pole is connected to the current lead-in with the piston while the other, preferably the positive, pole can be connected with the screening or the wall of the chamber.

In the accompanying drawing the invention is illustrated diagrammatically with reference to the constructional example, and Figure 1 shows a section through a light metal piston **1** the head part **2** of which is covered with a metal layer **3**, e. g. copper or silver, which is firmly anchored in the base material by the formation of an alloy layer **4** of the base material of the piston and the applied metal. In a similar manner the remaining part of the piston wall can be metallised as required. Moreover, the accompanying specimen shows a cross-section through a piston head provided e. g., with a silver layer the lower part of which is secured to the base material by diffusion. The two photographs which are further attached show in one case an alloy zone and in the other case a diffusion zone between the coating material and the base material.

The metal protective layer applied according to the invention was applied over the gas phase of the metal to be deposited in vacuo. It is also possible to begin with a solid or liquid phase of the metal to be applied. Thus, e. g., the material can be so highly heated in a crucible that it evaporates and condenses on the suitably arranged piston. For this purpose preferably a filling gas pressure of 3 to 10^{-6} mm. is used in the evaporation apparatus.

When using electrical disintegration filling gas pressures of e. g., 3 mm. to 10^{-3} mm. are used. The material to be disintegrated may be used in the liquid or solid state. According to the invention, when using thermal evaporation or cathode disintegration as the method of applying the metal the piston is brought to the temperature at which the material to be applied can be connected with the base material by diffusing or formation of alloy. This temperature is maintained until the desired depth of penetration of the applied material into the base material is reached. Then the temperature is slowly reduced in order to obtain the pure metal on the surface as a protective layer. According to the requirements it may be sufficient to produce only a diffusion or alloy zone. The desired formation of the layer is obtained by regulating the temperature of the piston to be coated.

Figure 2 shows a section through an apparatus for thermal evaporation of metal on to light metal pistons in vacuo.

The apparatus for thermal evaporation consists of a vessel **5** which can be evacuated and which can be hermetically closed by means of a cover **6** with a packing **7** interposed which can be cooled by means of the air passage provided in the cover, by means of the eccentric catch **8**. A vacuum pump which is not illustrated is connected to the branch **9** and through the branch **10**, if necessary, a preferably reducing filling gas, such as hydrogen, can be introduced in small quantities. By means of the vacuum pump any desired reduced pressure, for example under 50 mm. mercury, up to the highest attainable vacuum, can be obtained in the vessel.

The material to be evaporated, for example a metal or an alloy, is placed in the evaporating crucible **11** which is provided with a lining or insertion **12** which is not attacked by the metal to be evaporated. The heating of the crucible up to the evaporation of the metal is effected for example by means of a hollow high frequency coil **13** which can be cooled, the ends of which are led through the cover **6** into the vacuum vessel by means of the two current leads **14** and **15**, being insulated, vacuum tight and screened. The lead **14** is screened by means of the metal screening sleeves **16** and **17** arranged at a small distance from the lead and is covered by a protective cap **18**. **19** and **20** are two insulating bodies between which is a packing body **21**. The screw ring **22** is used for pressing the whole together. The current lead **15** is constructed in the same manner. The molten metal **23** evaporates in the crucible **12** and the vapour is deposited upon the metal piston **24** which is arranged on a current lead-in **25** which is hollow and can be cooled, it being possible to introduce through the pipe **26** and to withdraw through the branch **27** a cooling medium such as water. The parts **28** and **29** form two metallic screens which are arranged at such a small distance from the current lead-in and from one another that no glow discharge takes place in the intermediate spaces. The parts **30** and **31** are two insulating and sealing rings, while the part **32** is a pressure ring. By means of the cooling device **33** in the vacuum vessel the current lead-in is cooled and the cooling medium can be introduced through the branch **34** and withdrawn through the branch **35**. One end of the secondary winding **41** of the alternating current transformer **42** can be connected through the switch **43** with the lead-in **25**, and the other end of the secondary winding can be connected through the regulable resistance **44** and the switch **45** with the screening sleeve **28**.

The negative pole of a continuous current source **36** is connected through a switch **37** with the lead-in **25**, while the positive pole of the voltage source can be connected through a regulable resistance **38** either through the switch **39** with the screen **28** or through the switch **40** with the wall of the vacuum chamber **5**. The part **46** is a screening ring which can be used as required if the side walls of the piston are not to be metallised. The part **47** is a thermo element with the ends **48** and **49**. The part **50** is the vaporised metal layer and the part **51** is the supporting device for the piston.

In Figure 3, which shows a section through a cathode disintegration metallising chamber for light metal pistons made, for example, of aluminium, magnesium or aluminium or magnesium alloys, in which the wall is formed as the cathode to be disintegrated which surrounds the piston to be metallised on all sides, the part **52** is the removable metallic disintegration vessel hood which can be hermetically connected with the metallic bottom **53** with an interposed packing **54**, consisting for example of two rubber rings. The whole inner surface **55** of the cathode disinte-

grating chamber, that is, both the bottom and the hood, may consist of the metal or metal alloy to be deposited or may be coated therewith. Such metals may be principally chromium, molybdenum, tungsten, iron, cobalt, nickel, copper, silver, platinum, palladium, rhodium, cadmium, zinc, vanadium, tantalum, zirconium, aluminium, magnesium or the like, separately or in any desired combination. The vacuum pump, which is not illustrated, is connected to the branch **56**, while the branch **57** serves for introducing a neutral or reducing gas, such as nitrogen, hydrogen, a rare gas such as argon or the like. In the gas inlet **57** there is placed a sieve **57***a* and in the gas outlet **56** according to the invention a sieve **56***a* is placed which prevents a gas discharge, more particularly a glow discharge, striking into the gas inlet or outlet. The size of mesh of the sieve is, for example, smaller than 1 mm. The hood **52** is surrounded by a cooling jacket **58** to which the cooling medium, for example water, oil or air, can be supplied through the branch **59**. The cooling medium is led away through the branch **60**. The bottom can be conductively connected through the removable conductor **61** with the furnace vessel. The negative voltage is supplied through the current cable **62** which can be secured to the bottom.

The piston **64** to be metallised with the metal layer **63** rests, for example, on an insulating or conducting plate **65** which is carried by the lead-in **66** which can be cooled, through the intermediary of a body **67** of metal or insulating material. The part **68** is the anode which is insulated and is screened from the bottom plate **53** and the lead-in **52** by a narrow gap in each case and which is connected through the cable **69** with the positive pole of a continuous voltage source. The parts **70**, **71**, **72** are rings of insulating and sealing material. The ring **72** is pressed against the bottom by means of screens which, for the sake of simplicity, are not illustrated. Between the anode **68** and the wall of the disintegrating vessel which is connected up as cathode, the gas discharge required for disintegrating the metal and for heating the piston up to the desired alloying or diffusion temperature is formed at a pressure between 40 and 0.001, preferably about 5–0.1 mm. mercury. The cathode distintegrating chamber is further provided with a screened inserted observation glass **74**. The part **75** is a ring for covering the gap between the vessel and the bottom. The branch **76** serves for supplying the cooling medium for the lead-in **66** and the branch **77** serves for withdrawing the cooling medium. The bottom is provided with cooling passages **73**. The part **78** is a thermo element for measuring the temperature of the piston during the deposition.

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METHOD OF COATING PISTONS

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3 Sheets-Sheet 1

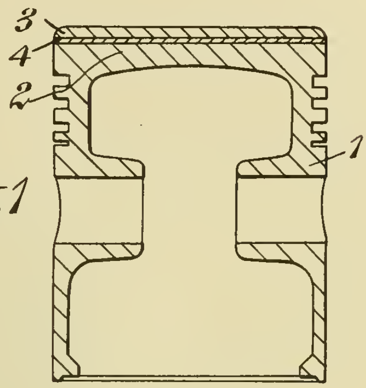

Fig.1

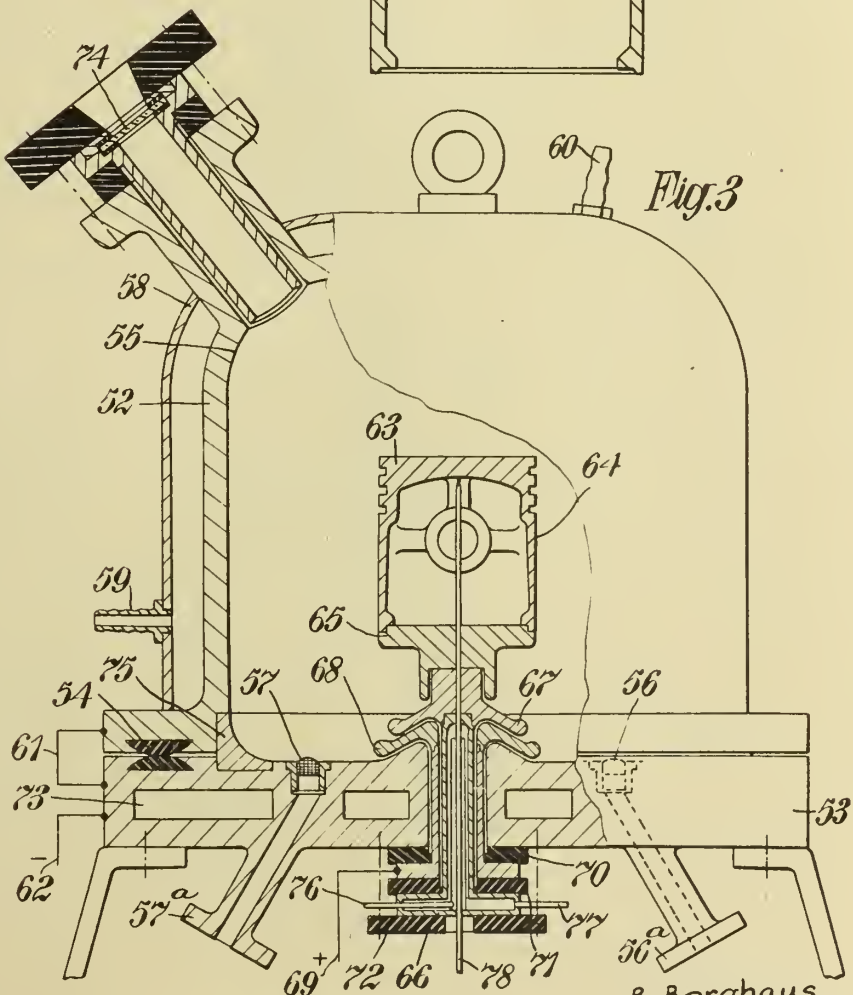

Fig.3

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3 Sheets-Sheet 2

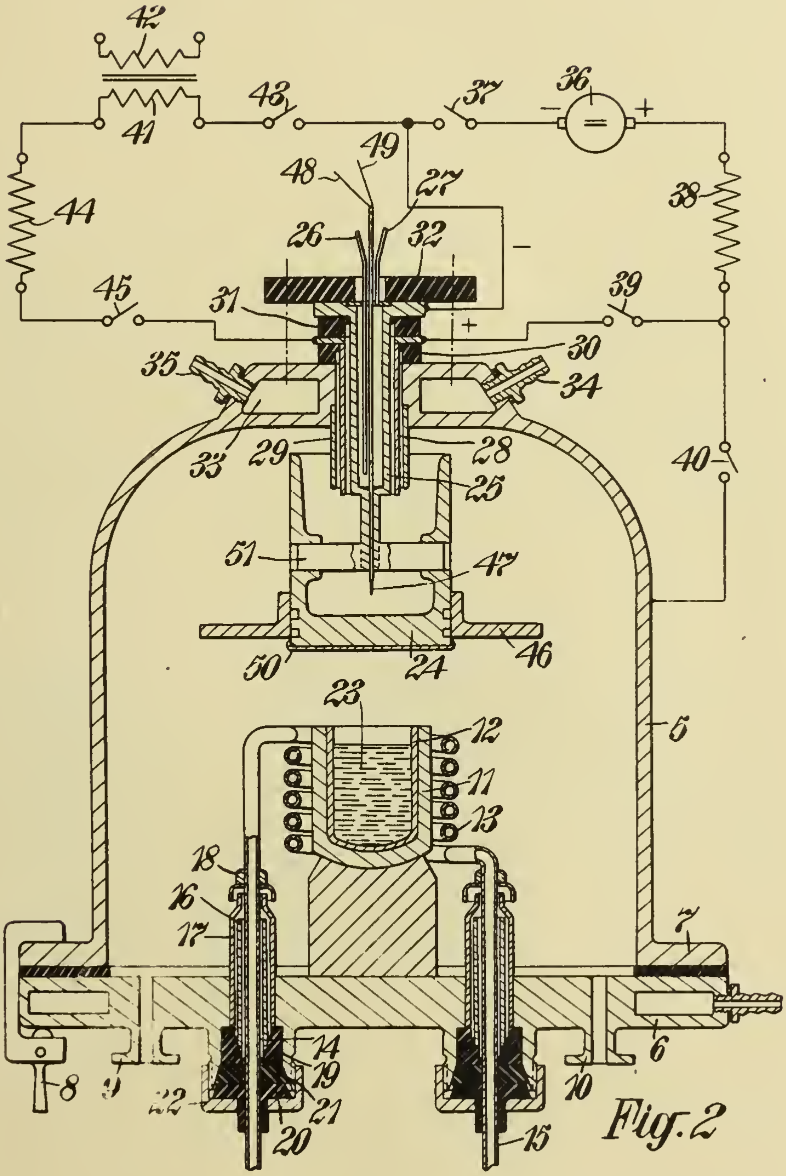

Fig. 2

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Fig. 4.

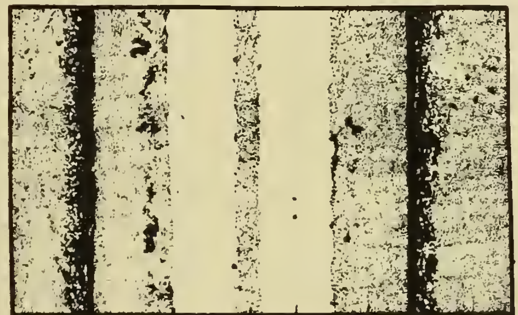

Fig. 4a.

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ALIEN PROPERTY CUSTODIAN

ADJUSTABLE CLOSED CIRCUIT GRINDING PROCESS

Aldo Bibolini, Turin, Italy; vested in the Alien Property Custodian

Application filed October 7, 1938

The present invention relates to a new grinding process carried out by the application of suitable hydromechanical devices, hereinafter described, capable of reducing to more or less fine granulated particles mineral ores or other solid materials in general, fed into the machine, either continuously or intermittently, even preliminarily reduced to large grains and held in suspension in a liquid (which may eventually be added to the material during the feed) in such a manner as to form a common pulp, of any density.

Through the effect of the grinding bodies, kept in motion by the rotation imparted mechanically to the casing containing them, the material under treatment is progressively ground, but differently from what takes place in known types of industrial mills not fitted with the devices to which this invention relates, the material is carried away from the container in which the grinding takes place as and when it attains a certain predetermined maximum granular size.

The adoption of the invention therefore eliminates the defect complained of in the aforementioned known types of mills, i. e. that of the production of a considerable percentage of overground material, often reduced almost to a colloidal state, and therefore practically wasted as far as successive industrial operations are concerned.

The principal feature of the grinding process carried out by the application of the devices to which the present invention relates, is therefore that of supplying a ground product, in granules all below a certain size, controlled by screening which is performed within the machine itself, which granules, containing only a small percentage of over-ground particles, form a pulp of appreciably uniform dispersion, such as to offer the best conditions for its eventual further treatment, for instance, in flotation processes, in combustion in furnaces using pulverised fuel, in chemical processes, etc.

As a consequence of the presence of the aforementioned screening apparatus, which is contained in a cylindrical or cylindro-conical or truncated-conical casing, connected to the container in which the grinding is done, and of the adjustability of the internal circuit, of which further mention will be made later, in grinding plants in which the present invention is installed, both the classifying and the thickening or decanting mechanisms (which are however indispensable in ordinary grinding plants) can be suppressed whilst yet obtaining from the machine in our case a product of the desired density, uniform and constant.

Lastly, the invention, in consequence of these eliminations, by virtue of the corelated presence of the immediate and repeated return to the grinding zone of the granules to be re-treated internally due to the already mentioned adjustable circuit and by the granulation of the product, far from over-grinding, makes it possible to effect a saving in driving power and in circulating water very considerable in comparison with similar quantities required for the working of the previously mentioned present mills.

These advantages are obtained by the adoption of the following hydrodynamic and mechanical details of the device for each one of which, as for the whole of them, the applicant claims priority:

(*a*)—The carrying off, by forced circuiting, hydrodynamically regulated through calibrated hydraulic resistances inserted in the circuit, of the ground pulp which issues through a screening zone or grid interposed between the mill and the aforementioned casing, the transport being effected from all points of the fluid mass and not only along its free surface, by means of suitable helical vanes fitted to the inner surface of the casing forming part of the device in question.

(*b*)—The continuous volumetric classification of the ground material, combined with the grinding within the mill, such classification being effected by a succession of screening surfaces, formed of drum screens or trommels which work in a centripetal sense and are contained in the above mentioned closed tubular casing, coupled to that in which the grinding is done and divided from it by a screening zone or grid, in such manner as to be easily fitted to existing mills with grinding bodies (balls, rods, etc);

(*c*)—The return into the mill (through the feeder mechanism or otherwise) of the material thrown out by the said screens and consequently its automatic re-grinding, causing to circulate inside the machine, with the aid of a spiral drum interposed between the said screening surfaces, the fluid mass which the prearranged hydrodynamic equilibrium maintains in the mill, so as to cause the unscreened material to return, as stated above:

Internally: (*a*) Either simply through the grid; (*b*) or from its central zone; (*c*) or lastly in the region of the mill feed, where is installed an axial conveyor pipe connecting the region just indicated with that of the discharge of the material repassing through the gauging casing;

Or externally: (*d*) In the feed chamber when the aforesaid pipe is prolonged so as to traverse, along its axis, the feeder scoop.

(*d*)—The adjustability of the return velocity, making use of the adjustability of the circuit, obtained by eventually added hydraulic resistances, either as calibrated diaphragms or in the form of suitable jets, at the discharge of the finished product, an adjustability which may be varied in correspondence with the physical properties of grindability and of liberation of the constituents of the ore or other material being treated;

(*e*)—The direct obtaining of the ground product, in pulp of the desired degree of concentration making use of the adjustability of the feed and of the aforementioned hydraulic resistances, beginning with the feed pulp of any concentration whatsoever, in such manner as to obtain, even without the aid of additional thickeners or decanters, the most suitable product for the best and most economical treatment of the pulp itself in successive elaborative processes (flotation, chemical treatment, etc).;

(*f*)—The arrangement in a closed circuit, actuated by gravity, (where it is desired to avoid the use of auxiliary hydraulic operating machinery), of a hydromechanical device comprising: a grinding apparatus fitted with the device in question arranged for forced circuiting and for the volumetric classification of the pulp and a decanting apparatus, from which all or part of the purified water coming from the circulating pulp flows back to the former, the said circulation taking place at a velocity which can be regulated, so as to avoid, yet with the greatest saving of fluid and with a minimum absorption of power, the over-grinding of the material under treatment and to maintain almost unaltered the fluid mass in motion.

(*g*)—Lastly, the invention relates to a mechanical device combining grinding, volumetric classification and decanting, which practically performs the new process.

The invention is illustrated in an entirely diagrammatical manner in the attached drawings in which: fig. 1 is a longitudinal section of a mill and grinding device assembly with its principal accessories; fig. 2 is a horizontal perspective view; fig. 3 is a view of it according to the arrow III in fig. 1; figs. 4, 5, 6 are longitudinal sections of grinding devices similar to the preceding one, differing only in the executive details, from the example shown in fig. 1.

No. 1 represents the body of a mill containing grinding elements (balls, pebbles, rods or the like) which in the drawing is shown cylindrical, but which may also be limited by either cylindrical or truncated-conical walls, rotating about an axis more or less horizontal I—II, on bearings of known type, not illustrated here.

One end of the mill is coupled to a pulp feeder comprising a rotating scoop 2 which dips into the tank 3 fitted with an adjustable skimmer for drawing off the excess water eventually present in the feed pulp and with an adjustable abduction pipe, arranged to replace, by means of suitable additions, the eventual deficiencies in the quantity of pulp and thus ensure that the finished product be of the required density. Into the tank 3 are fed, either together or separately, the material to be ground and the liquid which serves as a vehicle for the operation, which liquid may be water or another fluid, according to the nature of the operation to be performed, such as for instance, flotation, chemical reactions, etc.

The pulp, having entered at one end of the body 1, is ground by the action of the grinding elements 4, whilst it travels towards the other end of the said body and there goes through the wall 5 acting as a grid, either over its whole surface or anularly. From here the pulp passes into the conical casing 6, (or into the truncated-conical one 6') fitted with helical vanes on its inner surface and enclosing axially several conical drums, some of which are of perforated sheet metal or of wire gauze, others being wholly or partially of solid plating, to which are connected internally suitable helical conveyor elements. The diameter of the perforations in these screening trommels decreases progressively from the outer one to the central one 7, the fineness of which corresponds to the desired fineness of grinding. It follows that the grains which have been reduced to the pre-determined size pass through all the screening trommels and issue at the end D to form part of the pulp of pre-determined density, whilst those which have not been sufficiently reduced are progressively arrested by the screens and led back into the mill 1 by the action, either by the conveyor action of the helical projections fixed to the solid walls of the conveyor drums, or, as previously stated, by the similar action of the circulating water. They thus return to the body 1: (*a*) either in a statistical manner, directly through the perforations of the grid 5; or preordinately: (*b*) either through the opening in the dividing wall 5 corresponding with the bottom of the larger drum, and (*c*): either through the perforations 10 in an axial conveyor tube 11 which is installed in front of the aforesaid aperture, and into which they are fed by a lifting device situated within the above mentioned opening; (*d*): either within the feed bin 3, passing coaxially through the scoop. To each of the above mentioned four possibilities mechanical arrangements, differing only in detail and shown in the schematic figures 1–4–5–6, correspond. It is the system of helical vanes solid with the inner surface of the casing 6 which determines the circulation of the pulp which, as previously stated, begins with its entry into the mill (eventually together with material issuing from the perforations 10 to be passed again through the mill) and continues towards the exit D passing through the cylindrical body (or conico-cylindrical body) 1 as well as the peripheral part of the casing 6 as far as the said port, in correspondence with which through the effect of the hydraulic resistance acting in it and (although in minor order) of the conveying effect of the spiral drum, the flow branches off to return partially, in an adjustable stream, along the axial zone of the machine or in the outflow zone formed by the grid in its entirely or else in that part of it which is missing from the base of the larger drum, or else in the inlet zone 10, or finally in the feed bin.

The aforementioned system of vanes has such hydrodynamic properties as to allow the drawing of a larger volume of fluid than that of the inflow, so that it is capable of keeping in circulation inside a fluid mass predetermined in a desired measure, suited to a continuous circulation of the repassages through the mill at an adjustable speed dependent on the adjustability of the hydraulic resistances present in the circuit.

These resistances, in the form of jets or else of calibrated diaphragms arranged within the port D serve to more or less obstruct the outlet

section, so as to act in the desired way, and, all other conditions being equal, on the volume of the return flow.

Therefore by inserting adequate jets or calibrated diaphragms in the outlet port D and suitably acting on the skimmer contained in the feeder bin, it is easy to produce a pulp of density corresponding to the best and most economical treatment in successive processes, even when beginning with a feed pulp of any ponderal constitution whatsoever.

And lastly is it possible, if desired to interpose a receiver between the mill production and the machinery destined to further work upon it, to use suitable decanting apparatus. In this case, taking advantage of the head which is set up between the feed level and the raising of the pulp through the effect of the helical vanes eventually aided by elevating vanes in the outlet zone (in the case of cylindrical or conico-cylindrical casings), the outflowing pulp coming into the decanter **9** settles in it, whilst the decanted overflow liquid can return by gravity through the pipe **11** in the tank **3** of the feeder, in which is thus automatically preserved the desired feed level and density.

In the terminal portion of the bottom tube **12** of the decanter, from which the thickened product issues, a by-pass or other device then serves for the eventual addition to the outflowing product of a quantity of water sufficient to ensure the desired density, whilst grinding is effected within the mill with only that quantity of water strictly necessary for the operation, which remains practically constant throughout the grinding process. The above described grinding device, applied to mills with grinding bodies (balls, rods, etc.), determines therefore in them a working which differs widely from that of the industrial mills of the same technological class at present in use, inasmuch as the fluid stream running through the machine, carries away in a continuous manner the ground particles, not only from the free surface but also from the interior of the mass under treatment, whilst the hydromechanical energy acting on the said mass provides for numerous and rapid repassages of the particles through the mill, particles which the screens arranged inside the machine throw out little by little.

These peculiarities, inasmuch as they appreciably prevent any overgrinding and eliminate all intervention of separate classifiers and concentrators, assure to the mill an efficiency far superior (the energy absorbed being equal) to that of the previously mentioned existing mills.

On the other hand, the adjustment which, within extremely wide limits, can be effected, either by acting on the hydraulic resistances in the circuit, or by acting on the outflow ports of the eventually present decanter, allows of obtaining a pulp of predetermined density, in such a manner as to realise the greatest saving in the fluid necessary to form the pulp.

Lastly, it is easy to observe that the peculiarities excogitated in the functional coupling of the grinding container **1** with that of the classifying device under discussion, which are easily effected also by the adaptation of this part only to already existing mills, confer on the machine a compound character which, in combination with the results of the above described cinetic action, ensures the greatest economy in milling.

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ADJUSTABLE CLOSED CIRCUIT GRINDING PROCESS

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2 Sheets-Sheet 1

Fig. 1

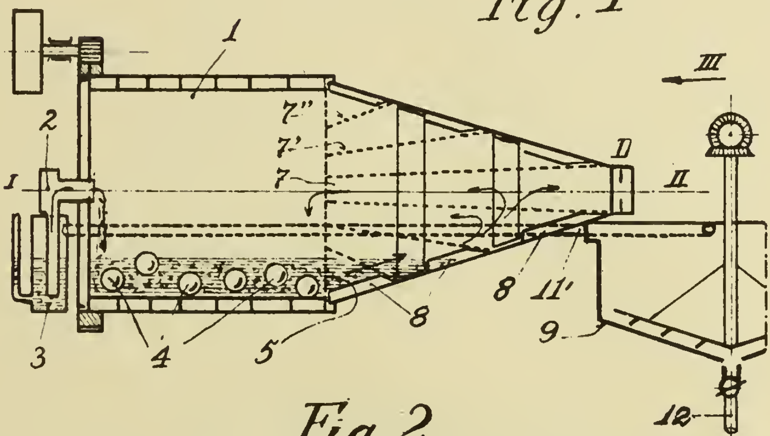
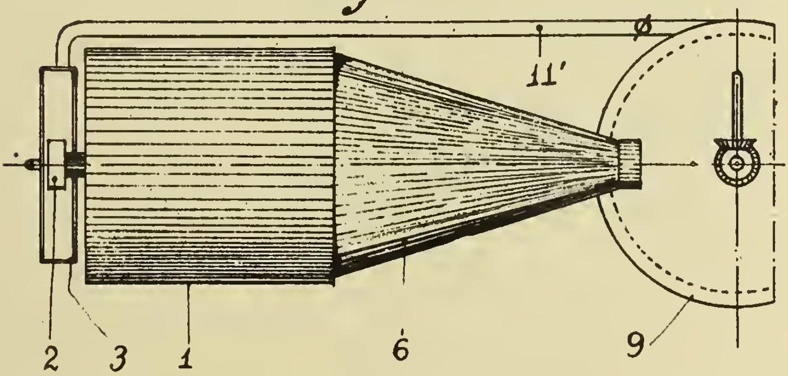


Fig. 2



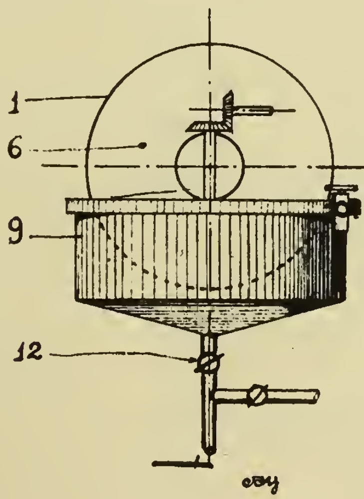


Fig. 3

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ADJUSTABLE CLOSED CIRCUIT GRINDING PROCESS

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2 Sheets-Sheet 2

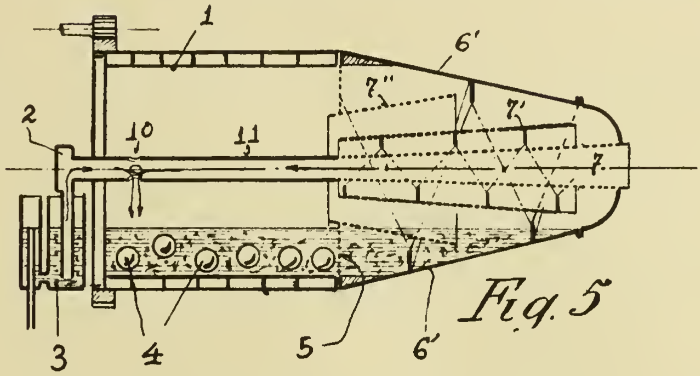


Fig. 5

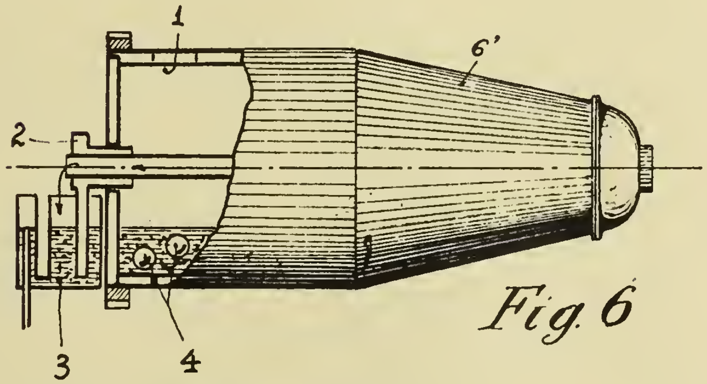


Fig. 6

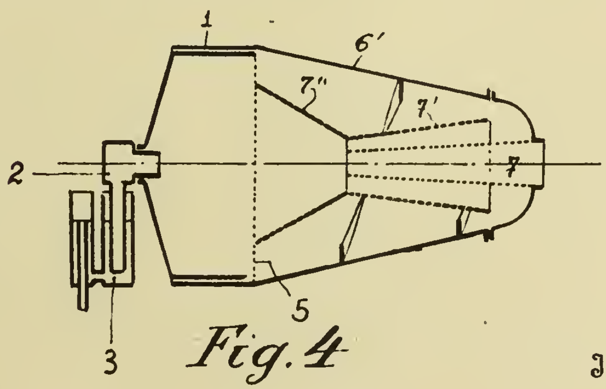


Fig. 4

Inventor

Aldo Bibolini

By E. F. Wenderoth

Attorney

Published May 4, 1943 Serial No. 237,302

ALIEN PROPERTY CUSTODIAN

PROCESS FOR REMOVING PRINTING INK FROM PRINTED PAPER

Berthold Rassow, Leipzig, Germany; vested in the Alien Property Custodian

No Drawing. Application filed October 27, 1938

The present invention relates to a process for removing printing ink from printed papers wherein upon reduction of the paper texture into fibre, the colouring matter located thereon is loosened and washed off so that it can be removed together with the waste water, or in the dispersed condition for example by adsorption rendered harmless. The fibre thus obtained may serve as half of the material for the production of new paper.

A number of such processes have already been proposed. For example it is known to carry out such a process with soap and trisodium phosphate has also been suggested for this purpose. Such proposals have, however, not hitherto led to a process of any practical value.

The process according to the present invention on the other hand, renders it possible to overcome the known disadvantages and enables the desired result to be readily, simply and effectively obtained, being of especial importance for rendering newspapers again usable for purposes other than the manufacture of pasteboard.

The invention consists in a process for removing printed ink from printed paper by reducing it to fibre in aqueous solutions of washing agents characterised by the feature that alkali or ammonium pyrophosphate is used as the washing agent. It is advantageous for the reduction to fibre to be effected in water which contains in suspension kaolin or any other usual loading substance, and the method of operation is the usual one as will be evident from the examples hereinafter described.

It is already known to add, during the washing of paper, a certain quantity of phosphate, for example to increase the hardness of the water. The addition of pyrophosphate according to the present invention does not, however, lead to this result. Pyrophosphate has been shown to be a particularly suitable washing agent for the present purpose and it is therefore itself used as a washing agent and not as an addition to another substance acting as a washing agent.

In carrying out the process the usual washing procedure is quite practicable but often in practice due to large quantities of waste water being necessary it is not quite suitable.

It is therefore an important further feature of the invention that the amount of waste water required can by a suitable sequence of operations be kept small and for this reason the present invention has a considerable advantage over the hitherto known processes. In this case the reduction to fibre is carried out at a fairly high concentration and to the pasty mass obtained is added ordinary pulp. This addition may be effected to the extent of 30% and more according to the residual colour obtained. The mass obtained often presents a blue shade which for the purpose of obtaining a commercial product may be compensated with soluble yellow colouring matter in the same way as a yellow colour can be removed by blue colouring. This compensation may of course be carried out at a later stage during the manufacture of the paper.

The results obtained will be more clearly seen from the following examples which are given only by way of example, it being understood that the invention is not limited to the particular examples herein described.

Example 1

150 g of printed newspaper are beaten up in a Hollander with 6 litres of water and treated with an aqueous solution of, 4, 5 g tetra-sodium pyrophosphate. After two hours agitation the liquid in which the printing ink is washed away is removed through a fine sieve. The remaining fibrous mass may according to requirements be used directly as half finished material for new paper or can be brought to a pulped form on a sieving machine.

The effects obtained are shown by the following whiteness measurements. Newspaper reduced to fibre had a whiteness value of 39 relative to permanent white (barium sulphate) and in the case of a comparative suspended wood pulp (raw, unbleached) the whiteness was 64. Waste paper treated by above described process had a whiteness value of 56–66. The strength of the fibres was shown to remain undiminished.

Example 2

200 parts by weight of newspaper waste sheets are added to 1,000 parts of water in which are dissolved 2 parts by weight of sodium pyrophosphate, mixed at room temperature in an edge mill and worked for approximately two hours.

In this case kaolin is preferably added to an amount corresponding to the desired loading of the paper, for example 30 parts by weight. The paste obtained is then added to a weakly acid pulp, i. e., the fibre obtained during the usual paper making processes. Instead of an edge mill other apparatus may of course be employed, for example a Hollander, ball mill, Jordan mill, refiner, rotary boiler or a container fitted with a pump installation. Such apparatus may also be coupled together.

In addition to tetra-sodium pyrophosphate other washing agents, for example soaps, soda, sodium octadecanolmethylaminoethansulphonate and the like may be used. The substances may also be added in a Holland mill. In this case to the waste sheets are added pyrophosphate and kaolin. Instead of newspaper other kinds of paper may of course be used with similar results.

BERTHOLD RASSOW.

troduced and then shaped in the manner described for suspension purposes.

In all the constructional forms described, and more particularly in the mounting of the compression girder bodies on reinforcing irons of the adjacent row of girder bodies, each second row of such bodies may be provided with reinforcing irons which only project or which are bent over the ribs, and which may subsequently be bent upwardly about the compression girder bodies.

Finally, it is to be pointed out that the method according to the invention can also be employed in combination with known constructions. Thus, more particularly for such roof parts where, in consequence of the girders being differently spaced, the existing pre-cast compression girder bodies cannot be used, or for filling the spaces between the compression girder bodies and the wall, there can be employed the known construction with shuttering in which the whole compression girder part is cast in concrete.

IGNATZ ADOLF KIRCHNER.

PUBLISHED

MAY 4, 1943.

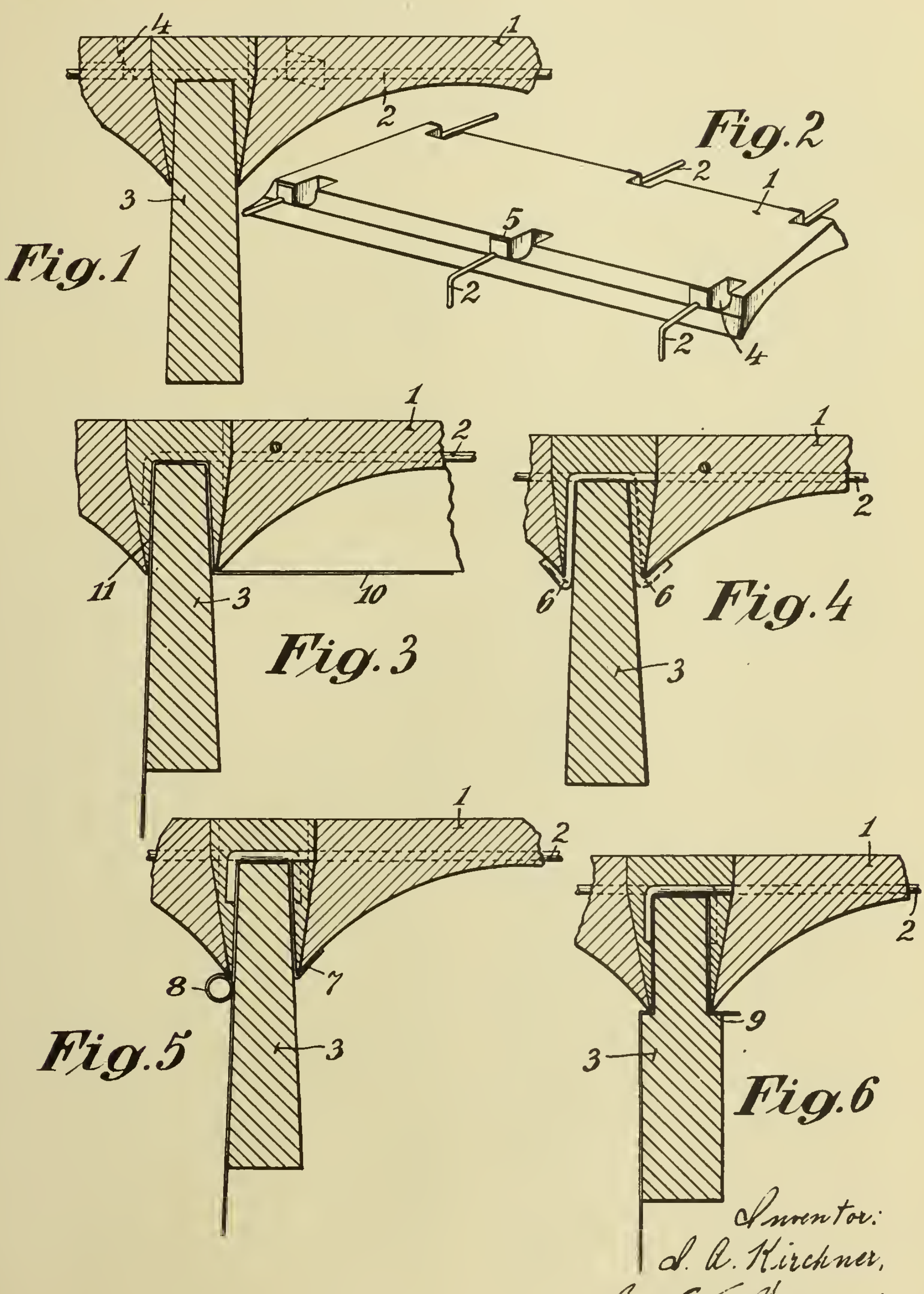
BY A. P. C.

I. A. KIRCHNER

MONOLITHIC FLOOR CONSTRUCTION

Filed Nov. 3, 1938

Serial No. 238,682



Inventor:
I. A. Kirchner,
By E. F. Wenderoth
Atty.

Published May 4, 1943

Serial No. 240,370

ALIEN PROPERTY CUSTODIAN

METHOD AND A MACHINE FOR THE PROGRESSIVE CUTTING BY GENERATION OF INVOLUTE TEETH

Jean Joseph Capelle, Clamart, France; vested in the Alien Property Custodian

Application filed November 14, 1938

This invention has for its object a method and a machine for the progressive cutting by generation of involute teeth of the rectilinear and helical gear systems for cylindrical spur wheels.

A certain number of gear cutting machines are provided in which the gear cutting method by generation of an involute is applied and in which the gear cutting tool which is used is a rack with projecting teeth of a prismatical form, the edges of the prism being parallel to the axes of the gear.

This cutting methcd essentially consists in mounting the cutting tool on a support member to which a predetermined rectilinear movement is imparted; on this support the tool moves according to a time law which, moreover, may be any law, and perpendicularly to the blank to be cut and its cutting edge has as the geometrical place the surface of its rack tooth.

Supposing that the cutting operation has been performed, a gear is obtained which is formed of a spur wheel correctly engaging the above described rack and it is quite convenient to define the said gear by the pitch surfaces of the blank of the cut gear and of the cutting rack which are a cylinder and a plane respectively.

It can be proved that if the blank is so rotated that its pitch surface rolls without sliding on the pitch plane of the rack, the surface which is described by the cutting tool will generate in the blank a complementary surface which will be the envelope of the first surface, both surfaces thus insuring correct conditions of engagement.

From what is disclosed above it may be seen that in every cutting machine operating by generation there are two kinds of movements to be considered:

1. The cutting movement or movement of the tool on its support, in the course of which the cutting edge of the tool describes the surface of the rack tooth, this movement being effected with a velocity which is a quite arbitrary one.

2. The generating movement proper or the movement of the blank with respect to the tool support. This movement generally results from two composing movements which, this time, depend one of the other and are effected with such velocities that the pitch surface which is bound to the tool support rolls on the pitch surface which is bound to the blank.

This cutting method can be called a rolling cutting method, since it may be readily seen that when the pitch surface of the tool rolls on the pitch surface of the blank with a linear velocity which is equal to the circumferential velocity of the said blank, the rack moves with the moving blank and engages, so to say, the wheel being cut so that each of the cutting teeth performs the complete cutting of a predetermined cut tooth; the same result would be obtained by causing the rack to roll on a blank of a plastic material, each tooth of the rack cutting in the said blank an indentation which would be complementary to this tooth.

It results therefrom that the number of teeth which are effectively cut is always equal to the number of cutting teeth; practically, the number of teeth of the gear to be cut is always higher than the number of the teeth of the rack; it necessarily results therefrom in all the machines in which the tool is a rack, and more particularly in the machines of Sunderland and Maag, a periodical return movement of the rack which is restored to its initial position, thus forming a certain number of dead cycles which are essentially disadvantageous to the efficiency of the machine.

It has been tried to do away with this inconvenience by insuring the continuous and progressive cutting of the teeth, thus permitting to eliminate these dead cycles, but one was led to give up the use of the rack tool, which is a rectilinear tool the construction and the operation of which are simple and practical ones, and to resort to tools which are much more complicated, such as milling-cutters, guide-screw ou cutters which offer certain inconveniences; more particularly they require complicated and expensive machines.

The cutting method according to the invention consists in using a tool-rack for the continuous and progressive cutting of rectilinear and helical tooth formations in cylindrical wheels.

The cutting movement is an alternating or reciprocal movement with predetermined trajectory and period of the rack on its support. This displacement is such that the trace of a tooth of this tool on the pitch plane is a straight line of a given length, the said plane being not, this time, bound to the rack, but having with respect to the latter a certain uniform velocity which is bound to the module to be obtained and to the period of the cutting movement.

The generating movement results from two movements which are in some way independent of each other, i. e. a slow horizontal movement of the carriage which supports the blank and which moves with a uniform and arbitrary velocity, and the rotating movement of the blank, the angular velocity of which is bound to the choice of the velocity of the carriage.

This generating movement permits to effect the continuous and progressive cutting of the totality of the circumference of the blank without it being necessary to periodically restore the rack to its initial position.

The method according to the invention is justified by the following considerations.

C being the pitch cylinder of the blank,
Q a marking plane which will be called the fixed plane,
P the pitch plane of the theoretical rack,
N a plane bound to P, and
T its trace on P (see Figure 1),

C rotates with a constant velocity, the fictitious rack (P, N) being such that its pitch plane P slides on Q while rolling without sliding on C in the manner of a belt, without there being in the course of the cutting operation any interruption in the movement of C and P. Finally, the tool is mounted on a support to which a plane P′ is bound which slides on Q′ with a uniform horizontal movement which is uninterrupted in the course of the cutting operation and with a velocity which is very small with respect to the velocity of P.

The performance of the cutting movement and of the generating movement will be successively justified:

1. Cutting movement

It will be supposed, first, that rectilinear tooth formations are to be executed (see Figure 2).

The tool-rack receives on its support a reciprocating horizontal movement in the course of which the trace m of a cutting edge describes with respect to P′ an arc of curve T′, this arc and its description law being such that when m passes from A to B its trajectory with respect to P is rectilinear and orthogonal to the velocity of the horizotnal movement of P on P′.

The arc T′ is obtained in the following manner. The point m describes on an arc $x'\,x$ a reciprocating movement $x=f(t)$ and the axis $x'\,x$ itself receives in the perpendicular direction Oy a reciprocating movement of very small amplitude and of the same period. The slope of the axis $x'x$ and the reciprocating movement of the same are so chosen that when m passes from A to B its trajectory T on P is a rectilinear one.

2. Generating movement

If P′ was fixed on Q, the relation between the rotation of the blank and the rotation of the shaft which causes the reciprocating movement of the tool-supporting slide would be the same as in the usual machines having a tool-rack, but, since the plane P′ slides on Q with a very small velocity v, the rotation velocity of the blank must be corrected by means of a differential gear.

In the appended drawings there are shown by way of example a form of execution of a gear cutting machine for carrying out the method according to the invention.

Figures 1 and 2 are geometrical views showing the method which has been described and which have been referred to in the course of the disclosure of the said method.

Figure 3 is a diagrammatical perspective view of the machine.

Figure 4 is an elevational view of the said machine.

Figure 5 is a longitudinal sectional view of the same.

Figure 6 is a plane view of the same.

Figure 7 is a side elevational view of the same.

The blank F, the plane of which is vertically arranged, is mounted on a carriage Ch moving with a uniform velocity v on the frame B. The plane Q of Figure 1 is bound to this carriage. Two worms V_1 and V_2 effect the rotation of the blank and the advancing movement of the carriage respectively.

On the other hand, on the frame is fixed a support S the position of which can be adjusted according to the pitch diameter of the blank. A head Te mounted on the said support has on the same a direction which can be adjusted about a horizontal axis which is perpendicular to Q, but which remains fixed in the course of the cutting operation. This head carries a slide C_1 which receives a reciprocating movement the amplitude of which is very small and controllable. This movement, which is obtained by means of a rocking shaft B_1 is controlled by means of a pivotal system and of a fork D by a cam K of a suitable profile.

The slide C_2 which carries the tool is mounted on the above mentioned slide; its reciprocating movement of variable amplitude is controlled by a finger Dg the position of which can be adjusted on a rocking shaft B_2; this rocking shaft is driven by a pitman and crank system.

The slope of the head Te is such that the guides of C_2 make the angle gamma with the vertical line.

Finally, the rack Cr, which works when moving downwardly, has on C_2 a position which can be adjusted about an axis which parallel to the axis of Te so that the active face of the tool is in a horizontal position. The removing of the tool at the end of its stroke is obtained by means of a roll and of a stop and a spring insures the restoring of the same.

Modification of the adjustment for cutting helical teeth.

The machine being adjusted in the above mentioned manner, it is sufficient to rotate the head Te by an angle α in either direction without changing the tool; with a new adjustment of the rotation of the blank a helical gear is thus cut wth right or left-handed teeth, the spiral angle of which being equal to α.

The machine according to the invention offers the following advantages.

The carriage receives a uniform movement which is very slow and without any interruption in the course of the cutting operation; it can be made very heavy and very stable; furthermore, the members for the cutting movement can have a small inertia and, accordingly, move with velocities which are rather high.

Owing to this fact and to the elimination of the above mentioned dead cycle which corresponds to the return movement of the carriage, a distinctly higher efficiency can be obtained with the machine as described.

Furthermore, in spite of the velocity of the cutting operation, which regularly takes place on the whole surface of the blank, the heating of the latter is a uniform one.

Furthermore, as shown in the disclosure of the method according to the invention, a simple modification of the adjustment permits of cutting helical gears; on the other hand, without changing the adjustment, wheels with a plurality of modules can be cut by means of tools of different modules.

Finally, the said machine, which performs the uninterrupted and progressive cutting by means of a rack is clearly found to be more economical and simpler than the machines which presently perform the same cutting operation but by means of complicated and expensive tools.

JEAN JOSEPH CAPELLE.

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MAY 4, 1943.

BY A. P. C.

J. J. CAPELLE

METHOD AND A MACHINE FOR THE PROGRESSIVE CUTTING BY GENERATION OF INVOLUTE TEETH

Filed Nov. 14, 1938

Serial No. 240,370

3 Sheets-Sheet 1

FIG. 1

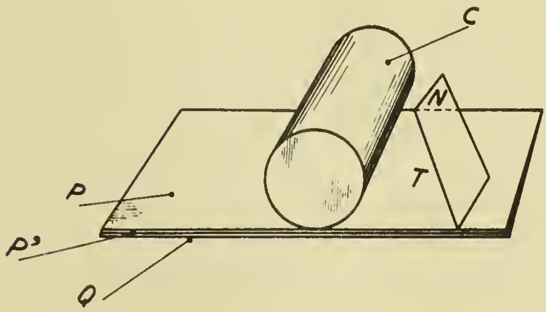


FIG. 2

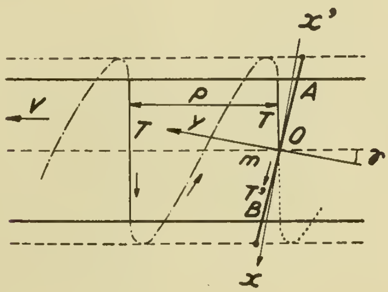
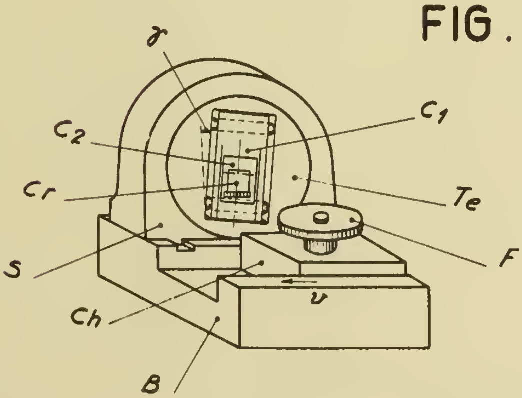


FIG. 3



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METHOD AND A MACHINE FOR THE PROGRESSIVE CUTTING BY GENERATION OF INVOLUTE TEETH

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3 Sheets-Sheet 2

Fig. 7.

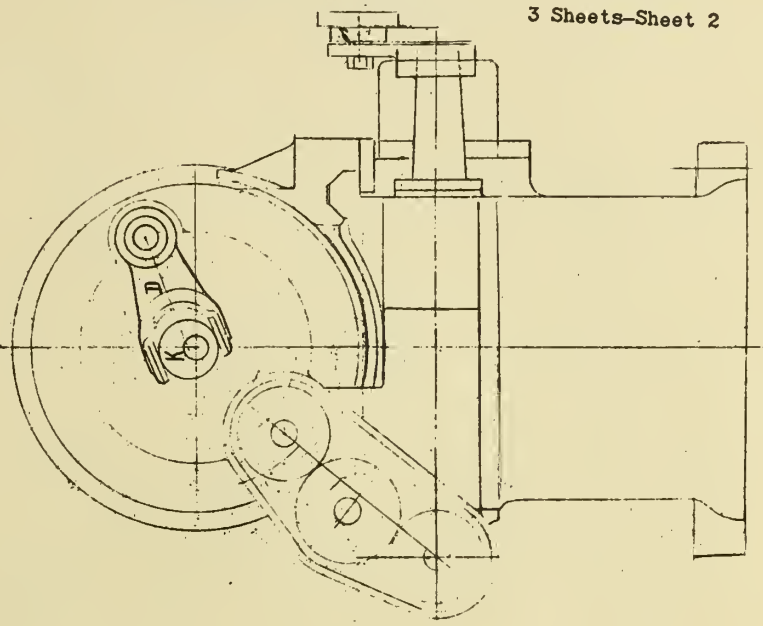
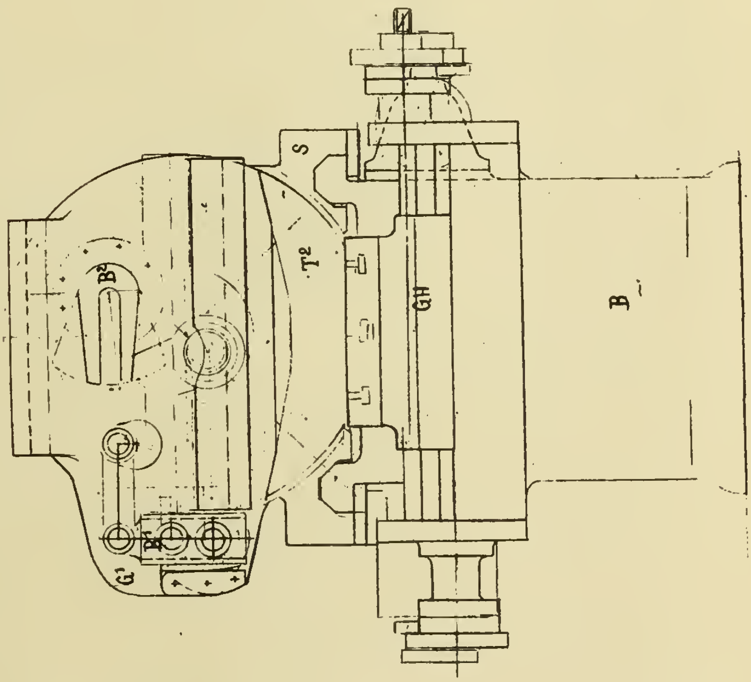


Fig. 4.



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3 Sheets-Sheet 3

Fig. 6.

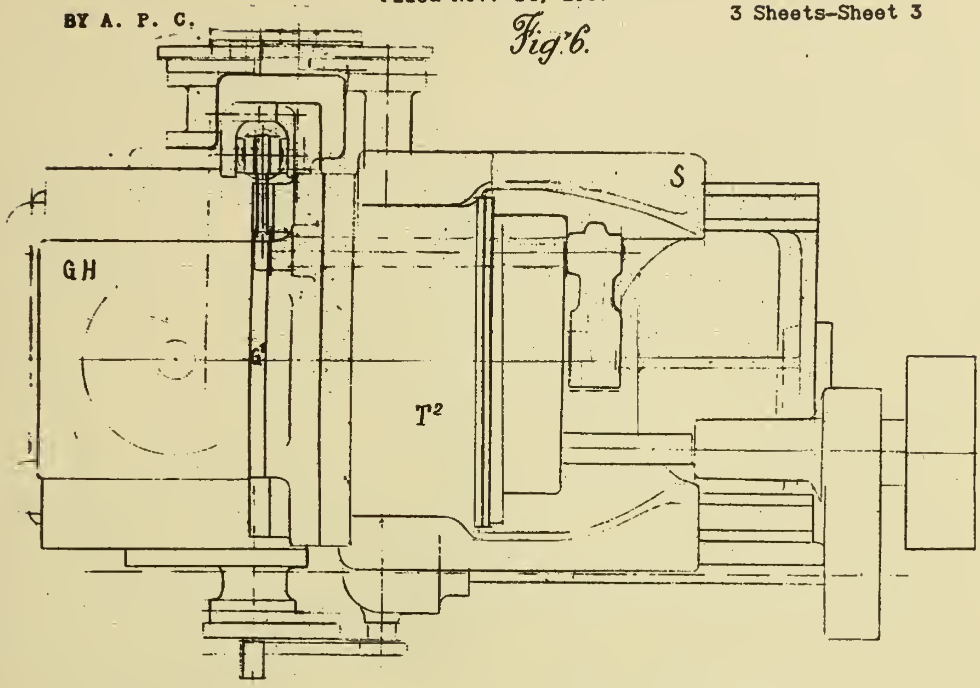
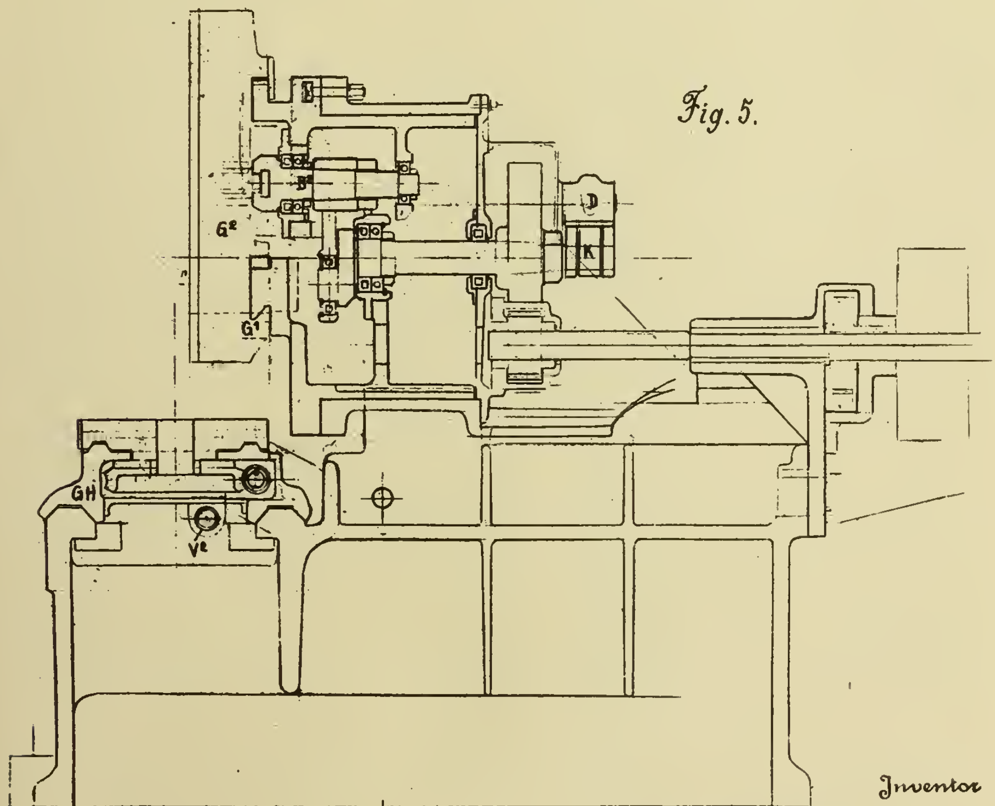


Fig. 5.



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Published May 4, 1943

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ALIEN PROPERTY CUSTODIAN

GRANULAR, LIGHT BUILDING SUBSTANCE

Carl Fabritz, Konigsberg, Preussen, Germany; vested in the Alien Property Custodian

No Drawing. Application filed November 14, 1938

My invention relates to a granular, light building substance.

It is an object of my invention to provide a substance of the kind referred to which possesses particularly favorable properties for building purposes, i. e., light weight, heat and sound insulation, adaptability, and low cost.

To this end, I provide grains of water-absorbing material, for instance, saw dust, and coat each grain individually with a binder which sets in the presence of water and is impermeable to water in set condition, for instance, cement.

It has already been proposed to manufacture light building elements by impregnating water-absorbing substances which swell to a greater or lesser extent when moistened, for instance, saw dust, with a very thin liquid binder, for instance, cement grouts, so as to "petrify" the substances.

This old process is complicated and slow since the impregnation requires a rather long time, and the mixture must be agitated repeatedly.

My novel substance, on the other hand, requires agitation of a few minutes' duration only and can be used directly, for instance, for making light-weight and insulating floors, or it can be used, with addition of some more binder, for casting, molding, or otherwise producing light building elements.

In the following description, saw dust will be described as the material for the grains to be coated, and cement, with or without sand, as the binder, but it is understood that I am not limited to this but may use other water-absorbing materials and other binders, provided that they are suitable for coating the grains of water-absorbing material.

The granular substance according to my invention is prepared as follows:

The water-absorbing material, for instance, 4 litres of soft-wood sawdust with a grain size not exceeding five millimeters, and one litre of cement, are mixed in dry condition. To this dry mixture is added a solution of a froth-forming agent, for instance soap, in water. The weight of the soap is 1.5 times the weight of the cement, and the weight of the water in which the soap is dissolved, is 2.5 times the weight of the sawdust. Waterglass at the rate of 10 to 15% of the weight of the water in the solution is added, and the mixture is agitated violently for about five minutes until a thick, frothy paste is produced. By the formation of the froth, so much moisture is withdrawn from the mixture that the walls of the froth globules are not supported by the binder but the binder is deposited on the grains of saw-dust as a coat. The water glass supports the walls of the froth globules, holding the grains in suspension until all the moisture has evaporated, and causing rapid setting of the binder in the coats of the grains. As the moisture is evaporated, the froth globules gradually burst. There is no adhesion between the coated grains, and the finished substance has the structure of coarse sand. It is stored in thin layers, and used directly, or for manufacturing light building elements, as will be described.

The amount of water added must obviously so determined that the grains are only coated, and not embedded in the binder. It is determined by the nature of the water-absorbing material, of the binder, and of the froth-forming agent. This agent may be dispensed with, if desired.

The binder may be mixed with a filler. In the case of cement as the binder, the filler is fine, and preferably dust-like, sand which is admixed to the cement preferably in dry condition. I have found that sand may be added at the maximum rate of one part of sand for one part of cement, by weight, and still a satisfactory coat on each grain is obtained which prevents subsequent access of moisture to the grain.

The percentages of the constituents of the granular substance obviously vary with the crude materials used. Thus, a higher percentage of water is required for Portland cement than for iron cement, and the same rule applies to finer sand as compared with coarser one. However, the principal factor which determines the percentage of the water, is the water-absorbing capacity of the grains. Sawdust can absorb about four times its own weight in water, but the amount of water must be under 2.5 times the weight of the sawdust, unless, as in the example recited above, a froth-forming agent is present, and the rate is 2.5 times. Only about one-half of the absorbing capacity of the sawdust is consequently utilized. Similarly, in the case of powdered peat whose water absorbing capacity is about 12 times its own weight, the weight of the water should be about 6 times the weight of the peat.

I have found by experiment that definite limits for the percentage of water can be determined for all crude materials in consideration. Under all conditions, the percentage of water must not be higher than what is required for setting the coats on the grains, without producing adhesion and conglomeration.

As mentioned, light building elements can be formed from the granular substance aforesaid.

This operation may be performed in a single stage, combining the coating of the grains and their binding together, or the two operations are performed in separate stages. In both cases, a certain amount of binder is added beyond that required for making the granular substance. The degree of compactness in the finished elements depends upon the percentage of water present. If such percentage is but slightly in excess of the minimum required for the formation of the granular substance, the element will be porous. It can be cast or molded under pressure but obviously there is a limit to such pressure since the element must not be crushed which would shut up its pores. If the percentage of water is much in excess of the minimum, a compact or non-porous element is produced, and this is preferably cast.

By way of example, the single-stage process may be performed as follows for making porous elements:

26.2 kilogrammes of best cement are intimately mixed with 10.4 kg of dry sand having the fineness of flour. To this dry mixture are added 15.6 kg of dry-soft-wood sawdust, and the sawdust and the dry mixture are again mixed intimately. 24.6 kg of water are added gradually and the mass is agitated to form a paste which can be cast, or molded under moderate pressure.

In the two-stage process, the granular substance is prepared as described, in the first stage, and preferably gypsum-free cement is used, or an accelerating agent, for instance, soda, is added. In the second stage, the additions of cement and a higher percentage of water are made. If the setting period of the cement is shortened by the means described, the two stages can be performed in the same mixer. The compact element thus obtained is preferably cast.

CARL FABRITZ.

Published May 4, 1943 Serial No. 241,255

ALIEN PROPERTY CUSTODIAN

FLAT KNITTING MACHINE

Max Nebel, Chemnitz, Germany; vested in the Alien Property Custodian

Application filed November 18, 1938

This invention relates to flat knitting machines for making piled fabric, with a plush loop for each sinker loop, or with plush loops for selected sinker loops only.

In such machines, the loops of the plush thread are sunk longer than the loops of the base thread by the jack sinkers and are then divided together with the base thread loops by the dividing sinkers and the descending frame needles. The jack sinkers are each provided with a throat for the plush thread and with a throat for the base thread. A vertical, or substantially vertical, edge extends downwardly from the plush throat. The dividing sinkers have two throats which are superimposed vertically, or substantially so, with a short projection between them whose upper edge is inclined in downward direction.

In order reliably to separate the plush and ground threads, and reliably to distribute them, extra separating members are provided in front of each dividing sinker and between the frame needles, for separating and/or distributing the threads issuing from the respective thread guides.

It is an object of the invention to so improve a flat knitting machine of the kind referred to, that the separating members are dispensed with.

Another object of the invention is to do away with the horizontal press motion of the needles so as to insure safe working during the production of pile fabrics, this object being attained by making the press itself horizontally movable in known manner and causing it during the pressing step to approach the needles which up to pressing time move up and down only in vertical direction.

To this end, in combination with a jack sinker of the kind described—which is old in the art—for sinking longer loops from the plush thread than from the ground thread, and for dividing the ground thread in forward direction means are provided for subsequently dividing the plush thread in downward direction only.

In such a machine, the ground and plush threads are sunk together in forward direction, and the plush thread is divided in the same direction, as usually, but the plush thread is not divided together with the ground thread by the dividing sinkers and the descending frame needles, the plush thread being divided completely and only in downward direction after the dividing of the ground thread.

In the accompanying drawings, a machine embodying the invention is illustrated more or less diagrammatically by way of example.

In the drawings

Figure 1 is a cross section of a complete machine;

Fig. 2 is a diagram showing the eccentric portion of a cam by which the needle bar of the machine is operated;

Figs. 3 to 8 are views drawn to a larger scale and showing various relative positions of the frame needles, jack and dividing sinkers, as follows:

Fig. 3 shows the sinkers in sinking position, and the corresponding frame needle at the upper end of its stroke;

Fig. 4 shows the sinkers and the needle at the moment the dividing throat of the dividing sinker begins to engage the ground thread previously to dividing it;

Fig. 5 shows the sinkers and the needle in dividing position;

Fig. 6 is a plan view of Fig. 5;

Fig. 7 is an end elevation, viewed from the left in Fig. 5, and

Fig. 8 shows the sinkers and the needle at the completion of the dividing operation;

Fig. 9 shows the loop forming tools in the same position as in Fig. 3, with the difference, however, that the edge of the plush throat extends in an oblique and not in a vertical, or substantially vertical, direction;

Fig. 10 shows the loop forming tools at the completion of the sinking operation;

Fig. 11 shows the loop forming tools at the beginning of the dividing operation;

Fig. 12 shows the loop forming tools during the pressing operation;

Fig. 13 shows the loop forming tools while the plush thread is divided in downward direction at the beginning of the putting-on movement;

Fig. 14 is a front view of the position of the loop forming tools shown in Fig. 13; and

Fig. 15 is a view drawn to a larger scale and shows a needle having two grooves and being arranged in the relative position of the loop forming tools shown in Fig. 4.

Referring now to the drawings, and first to Fig. 1, *a* is one of the end plates of a flat knitting machine, *b* is its head bar, of angle section, on which the sinker bar **4** is mounted with its jack and dividing sinkers, as will be described, **5** is the presser bar, and *c* is the needle bar. The needle bar *c* is supported by arms *d* only one of which is shown, and which are secured to a rocker shaft *e* mounted in the end plates of the machine. A cam lever *f* is keyed to the rocker shaft and equipped with a roller *g* for cooperation with a cam *h* on a shaft *i*. A spring *k* is

attached to the free end *m* of lever *f* at one end, and anchored in the frame of the machine at the other end. The spring holds the roller *g* against the edge of the cam *h*. The shaft *i* is rotated anti-clockwise by any suitable means, not shown.

The cam *h* on the shaft *i* is subdivided into a concentric member *h'* and an eccentric member *h''* which are connected to each other and to the cam shaft *i* by a suitable sleeve *o*. The eccentric member *h''* is shown separately in Fig. 2. It has steps *p, q, r,* and *s* at various radial distances from the axis *t* of the cam shaft *i*. Since the arms *d* and the lever *f* together make up a bell-crank, it is obvious that the needle bar *c* is raised when the roller *g* on the cam lever *f* is on a depression of the cam *h*, and lowered when the roller is on an elevation. Thus, since the radius *p—t* of the step *p* is the shortest one of the cam, the frame needles are in their topmost position when the roller *g* is on the step *p*. Conversely, the radius *s—t* of the step *s* is longer than the radius *p—t*, and so the frame needles are lowered when the roller *g* is on the step *s*.

The jack sinkers **6**, and the dividing sinkers **20**, Figs. 3–8, are mounted to slide in the sinker head **4**, and are operated by any suitable means, not shown. The ground thread **1**^{a} is delivered by a thread guide **1**, and the plush thread **3**^{a} is delivered by a thread guide **3**. Figs. 6 and 7 show the thread guides **1** and **3** at the end of their forward movement.

The jack sinkers are plush sinkers of the usual kind. Each jack sinker **6** has a lower throat **6**^{b} for the base thread **1**^{a}, and an upper throat **6**^{c} for the plush thread **3**^{a}. The upper or plush throat **6**^{c} is in advance of the lower or base throat **6**^{b}, and a vertical, or substantially vertical, edge **6**^{a} extends from the plush throat **6**^{c} down to a point **6**^{a} above the base throat **6**^{b}. Preferably, the edge **6**^{a} is slightly inclined in forward direction. Such jack sinkers are also used in the old flat knitting machines referred to, but in combination with dividing sinkers of the usual kind, and with the separating members referred to.

In the present machine, the dividing sinkers are modified, so that the separating members are dispensed with. Each dividing sinker **20** has only a throat **20**^{b} for the ground thread **1**^{a}, and its upper edge is stepped so that the dividing edge **20**^{d} is below the upper edge of the rear portion of the dividing sinker. In the example illustrated, the dividing edge **20**^{d} is at the level of the end **6**^{e} at the bottom of the edge **6**^{a}. However, this is only the upper limit, the condition being that the dividing edge must not be at a higher level than the lower end **6**^{e} of the plush throat in the jack sinker **6**. This includes any position of the dividing edge at a lower level.

On account of the low-level position of the dividing edge **20**^{d}, the outlet end of the thread guide **1** for the ground thread can be placed so low that shifting of the ground thread onto the plush throat **6**^{c} of the jack sinker **6** is absolutely prevented. On the other hand, the outlet end of the guide **3** for the plush thread **3**^{a} is placed at the normal level, i. e., just below the upper edge of the jack sinker **6**. Since the free length of the plush thread **3**^{a} is appreciably shorter than that of the ground thread **1**^{a}, see Figs. 6 and 7, jumping of the plush thread **3**^{a} into the throat **6**^{b} which is provided for the ground thread **1**^{a} in the jack sinker **6**, is absolutely prevented.

Before explaining the operation of the machine it is necessary to describe the special needle shown in Fig. 15. The novel feature of this needle is that it possesses two grooves **9**^{c} and **9**^{d} which are provided to prevent the extreme point of the dividing sinker entering between the needles from engaging any of them, the speed of the downward motion of the needle being so adjusted that the point of the dividing sinker located above the ground thread throat enters the needle row at the moment when it is positioned in front of the round shank portion **9**^{b} between the upper groove **9**^{c} and the lower groove **9**^{d}, as indicated in Fig. 4. The upper groove **9**^{c} is intended to receive the point **9**^{e} of the needle hook, and the other groove **9**^{d} serves for inserting therein covering needles for covering, narrowing, patterning, etc.

The operation of the machine will now be described. In Fig. 3, the jack and dividing sinkers **6** and **20**, and the corresponding frame needle **9**, with its hook **9**^{a}, are in the sinking position. This occurs when the roller *g* of the cam lever *f* is engaged by the step *p* of the eccentric cam portion *h''*, and Fig. 3 is shown, on a much reduced scale, in line with the radius *p—t*, in Fig. 2. Since the step *p* is a depression, the needle bar *c* is elevated, and the hooks **9**^{a} of all frame needles are in their topmost position, as shown in Fig. 3. The jack sinker **6**, through its throat **6**^{c}, has sunk the plush thread **3**^{a} into a loop which is longer than the loop into which the base thread **1**^{a} is sunk by the lower throat **6**^{b} of the jack sinker **6**. Both loops are horizontal, and slipping down of the plush thread **3**^{a} after sinking is prevented by the forward inclination of the edge **6**^{a} at the lower end of the plush throat **6**^{c}.

After the sinking of the loops, the dividing sinker **20** advances into dividing position. During the first stage of the corresponding movement of the dividing sinker, the frame needles **9** descend at a more rapid rate than in the old machines. In these, the frame needles, at the beginning of the dividing operation, have moved only through a short distance from their topmost position corresponding to the sinking operation. In the present machine, however, the step *q*, Fig. 2, whose radius *q—t* is longer than the radius *p—t* of the preceding step *p*, moves down the needles **9** so rapidly that, as shown in Fig. 4, the hook **9**^{a} of the descending needle engages the loop which the jack sinker **6** has sunk from the plush thread **3**^{a}, at the moment the throat **20**^{b} of the dividing sinker begins to engage the ground thread **1**^{a} to divide it between the needles **9**. It is necessary that the loops from the plush thread **3**^{a} should be thus engaged by the needle hooks **9**^{a} in order to prevent throwing-over beyond the upper ends of the needles, of the loops from the plush thread **3**^{a} as they become slack upon the return movement of the jack sinkers **6**.

Fig. 5, and Figs. 6 and 7, illustrate the dividing position of the sinkers and the corresponding frame needle when the step *r* of the cam portion *h''* engages the roller *g*. The dividing operation involves only the ground thread **1**^{a} which is engaged by the throat **20**^{b} of the dividing sinker, and is in line with the corresponding throat **6**^{b} of the jack sinker **6**. The plush thread **3**^{a}, however, is not influenced on account of the low-level position of its dividing edge **20**^{d}.

Upon further rotation of the cam *h*, the step *s*, whose radius *s—t* is longer than the radius *r—t* of the preceding step *r*, engages the roller *g* and moves the needles down into the final divid-

ing position, Fig. 8, and the needles now divide in downward direction the sunk plush thread 3^a.

By dividing the plush thread 3^a in downward direction only, it is possible to make the front ends of the dividing sinkers **20**, with their edges 20^d, as low as shown, the upper limit for the position of the dividing edge 20^d being the lower end 6^e of the plush throat 6^c, as described, permitting of the favorable position of thread guide **1**, as also described.

Fig. 9 shows the same mode of operation as Fig. 3 for producing plush as described and by the same means. The only difference is that the jack sinker is fitted with a plush throat in which the edge of the sinking throat does not extend vertically, or substantially vertically, like the edge 6^a shown in Figs. 3–8 but in oblique direction so that the throat 6^c is limited by an acute angle. This sinking throat edge is designated 6^f in Fig. 9.

Figs. 10–14 serve to show that an increase in th speed of the downward motion of the needle to insure safe embracing of the plush thread at the beginning of the dividing operation may be rendered unnecessary by starting the dividing operation later than usual. This is possible, as will be described, when the needle does not carry out a horizontal press motion and the latter, as known per se, is performed by the press. This delay of the beginning of the dividing operation is not possible when the needle moves in the ordinary manner. Dividing must therefore be completed when the needles move toward the press and the sinkers are returning also.

By providing for vertical needle motion only, from the sinking to the pressing operations, in the production of pile fabric the dividing motion of the dividing sinker becomes independent of the pressing operation. It is thus possible to begin at this descent of the frame needles with the dividing of the ground thread at ordinary speed only when the frame needle is at so low a point that the plush thread is inside the needle hook.

The plush thread guides **31** and **32** and the ground thread guides **33** and **34** are so arranged that the guides **31**, **32** deliver their plush thread just below the upper edge of the jack sinker **35** and the guides **33** and **34** their ground thread barely above the upper edge of the dividing sinker **36**. The jack sinker **35** possesses the usual plush throat **35***a* arranged in front of and above the ground thread throat **35***b*. The dividing sinker **36** whose top edge **36**c is located just below the plush throat **35***a* is provided only with a ground thread throat **36***b*. Both sinkers are disposed in known manner in a sinker head **37** which has no presser edge, as is known also, and the edge **37***a* which could serve as such is placed so far back that movable presser tools can be arranged instead of the presser edge. Various types of presser tools serving as means for producing a needle motion free from presser motion are known including for instance presser tools **38** which operate from below and are individually or jointly movable.

It is immaterial how such presser tools **38** are constructed, provided they are movable in horizontal direction. **39** are the needles and **40** is a knocking-over comb. **41** is the plush thread and **42** the ground thread.

According to Fig. 10, the sinking operation is completed and the forward movement of the dividing sinkers has begun. The actual dividing operation starts later than provided for by the known operating method of the dividing sinkers in the old machines. The movement of the dividing sinkers between the needle rows begins shortly before the needle groove **39***a* comes within range of the sinker nib **36***d* during the descent of the needles, i.e., the beginning of this movement is so timed that the point of the dividing sinkers cannot engage the needle groove and keeps the ground thread separated from the plush thread, whereas the subsequent retardation of the beginning of the actual dividing motion brings it about that prior to the actual distribution of the ground thread the needle occupies so low a position, see Fig. 12, that the plush thread is already in the hook. Farther descent of the frame needles **39** is effected at the regular downward speed, and the movement of the dividing sinkers is so adjusted that actual distribution of the ground thread and the return of the jack sinkers and needles connected therewith occur only when that portion of the plush thread **41** hugging the shank of the needle is positioned inside the hook, as indicated in Fig. 11.

Fig. 12 shows the known motion of the presser device **38** relative to the needle which is pressed without carrying out a horizontal motion towards the presser means. When the return motion is continued, as shown in Fig. 13, the press moves away again from the needles into initial position, and the sinkers begin their return motion R.

While the needle performs the movements shown in Figs. 12 and 13 the loops sunk from the plush thread **41** are divided to form plush loops **41***a*. The upper edge **36**c of the dividing sinker **36** remains between the needles until the plush thread has been finally divided. As the return of the sinkers does not depend upon a presser motion of the needles, the plush loops may rest on the upper edge **36**c up to the beginning of the putting-on operation.

Fig. 14 shows in a particularly clear manner the position of the thread during dividing in downward direction while the loop forming tools are in the position shown in Fig. 13.

MAX NEBEL.

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BY A. P. C.

M. NEBEL

FLAT KNITTING MACHINE

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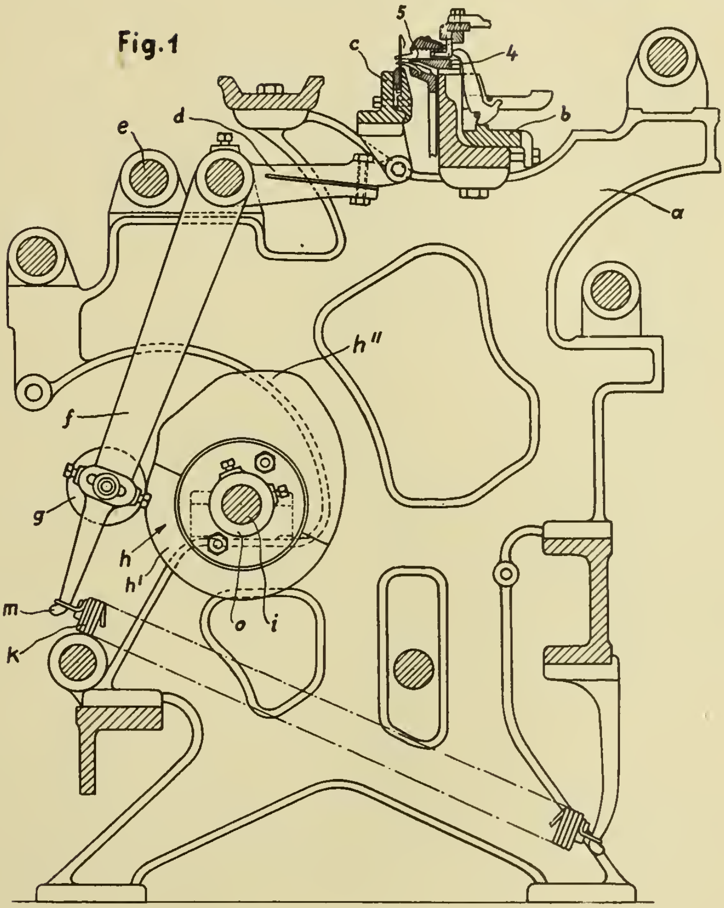
Serial No. 241,255

3 Sheets-Sheet 1

Fig.1



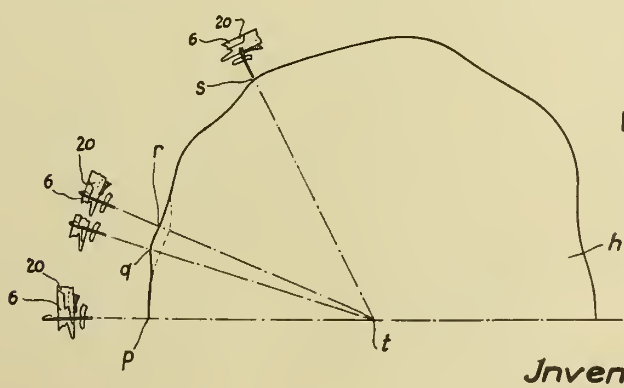


Fig. 2

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Fig. 3

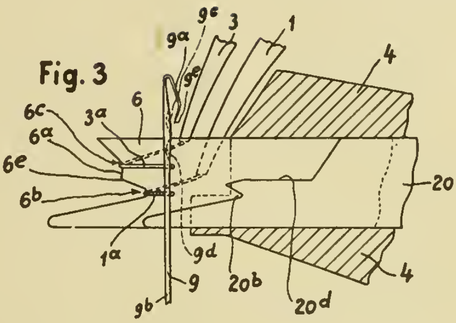


Fig. 4

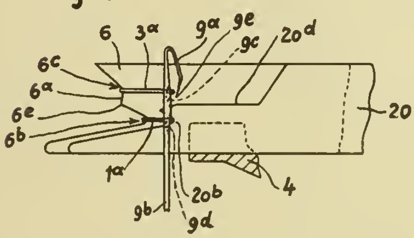


Fig. 5

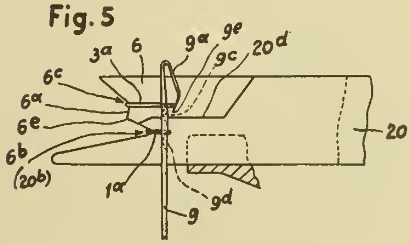


Fig. 8

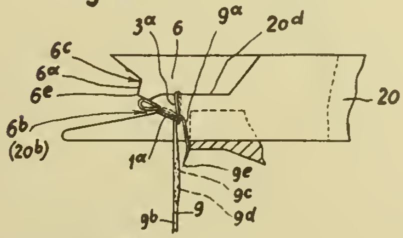


Fig. 9

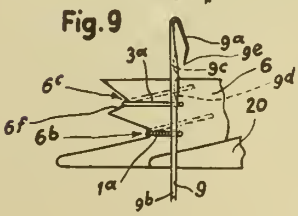


Fig. 15

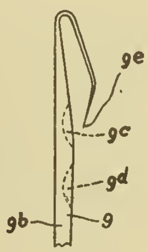


Fig. 6

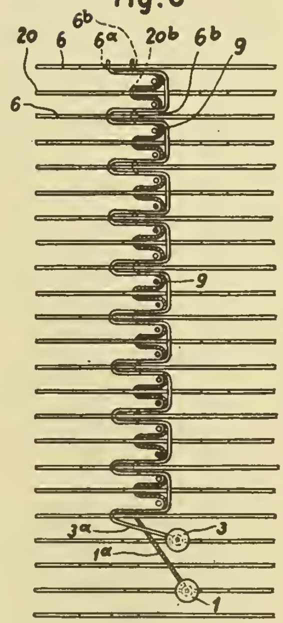
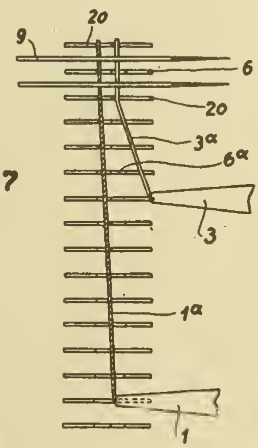


Fig. 7



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3 Sheets-Sheet 3

Fig.10

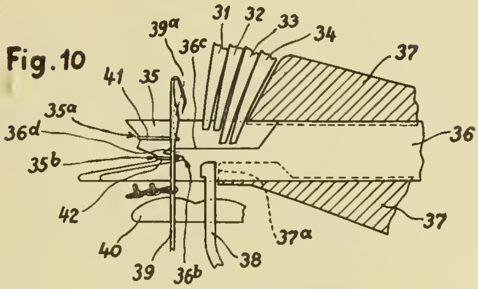


Fig.11

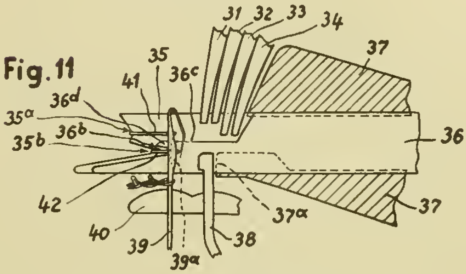


Fig.12

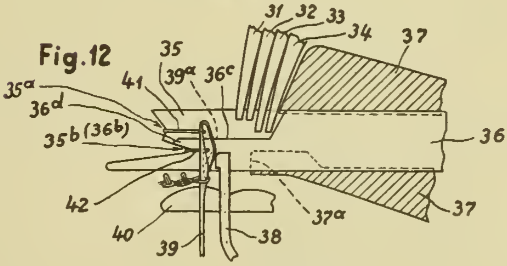


Fig.13

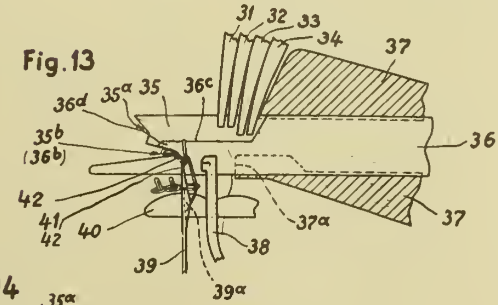
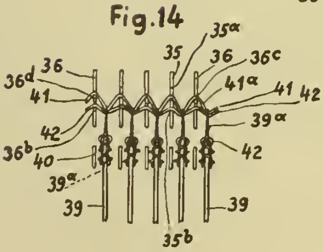


Fig.14



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ALIEN PROPERTY CUSTODIAN

NUTS

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Application filed November 19, 1938

The present invention relates to nuts of the type which, for constructional reasons, such as in the manufacture of aircraft, are required to be of light weight yet have great strength as regards their screw connection.

For this purpose it is known to use nuts of light metal of various alloys, but with these nuts it is difficult if not impossible to obtain the same strength of connection as can be achieved with steel nuts. In particular, in the case of light metal nuts the strength against wrenching of the turns of the thread is frequently not adequate. Also, it often happens that the first turns of the thread of the nut are damaged if the bolt is applied at an angle other than a right angle, and this applies especially when steel bolts are used. Steel bolts also easily wear the light metal thread of the nut, and further, the turns of the thread are frequently fractured or broken by constant jolting.

In order to eliminate these drawbacks, a nut according to the present invention is so constructed that its inner thread is formed wholly or partly by a bush of steel or other heavy metal, which is bedded so as to be incapable of rotation in the nut element, which consists for the remainder of light metal.

With a construction of this kind, the light metal nut element may have any desired formation, for example, it may be an ordinary hexagonal nut, or it may be a flanged nut for riveting on. The weight of the light metal nut as a whole is only increased to an inconsiderable degree by the inserted steel threaded bush, while the strength of the thread and thus the strength of the screw connection correspond to that of a steel nut. In addition, there results the advantage, as compared with steel nuts, of simple and cheap manufacture together with the avoidance of waste of material.

Together with the steel threaded bush, any desired locking element can be installed into the light metal nut at a suitable point, or the steel bush can also act as a locking element itself, e. g. by known slotting. In order to preclude with certainty any wrenching of the steel threaded bush out of the light metal nut element, even on high tensile strains, it is of advantage to construct the bearing surface for the steel insert conically.

Further, with the present invention, a locking of the components of the nut against any form of twisting is obtained in a manner which is very simple from the manufacturing point of view, in that the rim or the superficies of the steel bush is provided with teeth or longitudinal ribs, of which the diameter is somewhat larger than the internal width of the cavity, which receives the bush, in the light metal nut. When a steel bush is inserted or pressed into the light metal surround, longitudinal grooves are formed on the inner wall of the cavity in the nut, which grooves then protect the fibre rings, which are likewise inserted into this cavity after the bush and are clamped fast by bending the rim of the nut inwards, against rotation.

The invention is more particularly described with reference to the accompanying drawing in which:

Figures 1 to 4 show a flanged light metal nut partly with an inserted thread bush of heavy metal and with a locking element of resilient material.

Figures 5 to 10 respectively, show various forms of construction of an inserted threaded bush.

Figure 11 shows a modified form of construction of a heavy metal threaded bush, whilst

Figures 12–13 show the light metal surround of the nut, and

Figure 14 the two elements combined.

Figures 15 and 16 show flanged light metal nuts into which conical heavy metal threaded bushes are inserted.

Figure 17 shows in section a hexagonal nut of light metal with a heavy metal threaded bush and a locking ring of resilient material.

Figures 18 to 22 show a further modification of the elements of a nut both separately and combined to form a nut for riveting on with a pressed in heavy metal threaded bush provided with circumferential grooves and with locking elements of resilient material.

In the construction according to Figures 1 to 3, a threaded bush **1**, of steel, which is grooved on its periphery in the manner shown in Figure 5, is so inserted into a flanged riveting nut **3** of light metal that the thread **4** of the complete nut consists partly of light metal, but substantially of steel. Above the threaded bush **1** there is bedded into the light metal nut by flanging its upper rim **6**, a locking ring **5** consisting of a resilient material. As shown in Figure 4, the bearing surface **2** for the threaded bush may also be of conical construction.

The inserted threaded bush may be prevented from turning in the light metal part **3** of the nut in various ways. As an example in the construction according to Figures 5 and 6, the outer surface of the threaded bush is grooved. In the construction illustrated in Figure 7, the threaded

bush is of oval formation externally, whilst in Figure 8, the threaded bush has two side lugs **26**. The threaded bush may also be constructed externally as a square or hexagon, as illustrated in Figures 9 and 10.

Instead of using a locking ring **5** of resilient material, the bush can be locked in position within the flanged surround **3** by virtue of the shape and formation. Thus, the threaded bush **7** of Figures 11 and 14 is provided with slots **9** at the end projecting out of the light metal part **8** of the nut. That end of the threaded bush **7** which is bedded into the nut has, in this case for instance, a conical milled bearing surface **10**, against which the originally cylindrical wall **11** of the riveting nut **8** is pressed.

According to Figure 15, a steel threaded bush **12** may also be inserted into the light metal nut **13** in such a manner that the two ends **14** and **15** of the steel threaded bush are shrouded by light metal. In this case, the locking ring **5** for the screw is placed upon the light metal intermediate wall **16**, so that it is separated from the steel threaded bush. In this manner it is possible to protect the steel threaded bush from the admission of moisture. This form of construction is formed for instance by die or pressure casting.

Figure 16 shows another form of construction in which the threaded bush **17** has a groove **18** into which the upper rim **19** of the light metal nut **20** is pressed. In Figure 17 is shown a hexagonal nut **21** of light metal with an inserted threaded bush **22** of steel. Between the threaded bush **22** and the upper flanged rim **23** of the light metal nut **21** there is again bedded as in Figure 1 a locking element **24** of resilient material. The thread **25** of the complete nut also consists here partly of steel and for the remainder of light metal. A steel threaded bush may also be inserted into the light metal nut in such a way that the entire thread of the complete nut consists of steel.

In the case of nuts in which fibre rings or the like are inserted for the purpose of locking the nut against twisting, it is desirable that not only the steel bush carrying the inner thread but also the locking rings should be incapable of rotation either relatively to each other or relatively to the nut part consisting of light metal. This, however, cannot always be obtained with sufficient certainty with the fibre rings by simple clamping of the inwardly bent rim of the nut. With the present invention, however, an additional protection against twisting can be obtained by pressing in a steel bush of which the diameter is somewhat larger than the diameter of the bore. When the grooved steel bush is inserted there are formed on the inner wall of the bore longitudinal grooves which prevent rotation of the fibre rings subsequently inserted into the bore (Figures 18–22).

A particularly advantageous construction consists in that the superficies of the steel bush is smooth-walled and slightly conical in the lower part and is toothed or provided with longitudinal ribs only in the thicker upper part, while the inner wall of the bore in the nut, which bore receives the bush, has an obliquely rising annular shoulder into which the longitudinal ribs or teeth of the steel bush penetrate more strongly or more deeply when being pressed in than into the upper part of the wall past which the bush is pushed when being pressed in, thus cutting longitudinal grooves. The teeth of the upper part of the superficies of the bush thus fulfill a double purpose in that on insertion of the bush firstly there are cut longitudinal grooves which impede rotation of the locking disc, and secondly, there is obtained a firm anchoring of the steel bush itself in the light metal.

As shown in Figure 19, the steel bush carrying the internal thread consists of a lower, smooth-walled slightly conical part **5** and of a thicker upper part **6**, which is toothed or provided with longitudinal ribs. When the bush is being pressed in, these longitudinal ribs cut corresponding longitudinal grooves **8** in the inner wall of the bore of the nut, which consists of light metal (Figure 3). In addition, the teeth penetrate particularly deeply into the light metal on the obliquely rising annular shoulder **4** of the cavity and protect the bush against twisting relative to the light metal element. However, the fibre rings **7**, which are pressed in after the bush and which are clamped firm by the inwardly bent rim of the nut, are also protected against turning by the grooves **8** cut in the inner wall when the bush is pressed in. The same form of protection against twisting as in the riveting nut provided with flanges **27** and bores **28** may obviously also be used with hexagonal nuts and the like.

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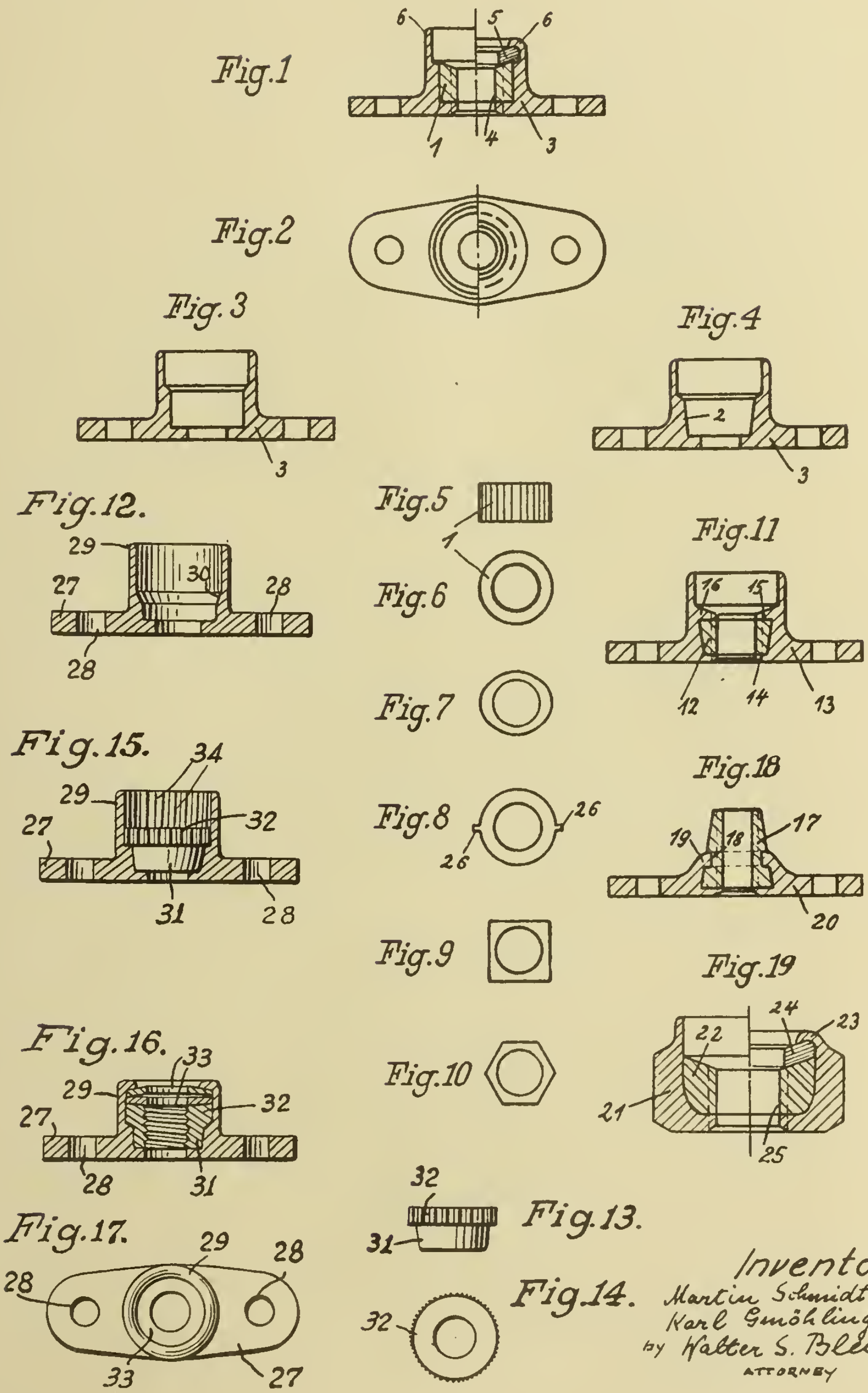

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2 Sheets-Sheet 2

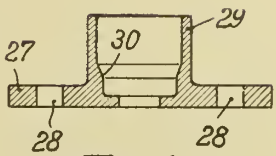

Fig. 12

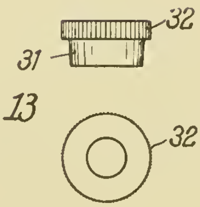

Fig. 13

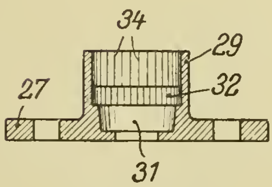

Fig. 14

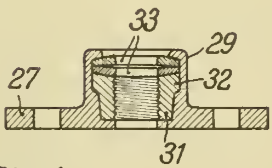

Fig. 15

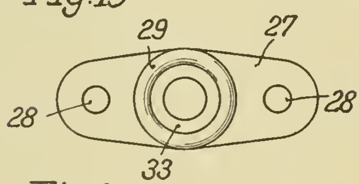

Fig. 16

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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF GRITS OR GROATS

Jørgen Petersen, Svendborg, Denmark; vested in the Alien Property Custodian

No Drawing. Application filed December 14, 1938

This invention relates to the production of grits or groats of oats or other similar cereal grains (for instance barlow) containing fat within their starchy portion.

In the production of grits the shales are removed so that substantially nothing but the seed kernel is left. Said kernels in most cases are further subjected to various treatments which may consist in comminuting the kernels by passing them between milling stones or rollers having sharp-edged ridges or grooves thereon. Such comminution may also be carried out before removing the shale. The whole or comminuted kernels may be subjected to further finishing treatments, f. inst. they may be flattened between smooth rollers, and in some cases they are further subjected to a treatment by steam in order to improve the keeping qualities and make the starch more readily soluble. The flour or meal produced during gritting or during the passages of the product between comminuting or flattening rollers may be removed by sieving.

The grits thus produced are very poor in carotene and vitamin A. The present invention relates to a process, by which the lack in carotene and vitamin A of the usual grits, especially oat grits, is compensated for.

This is done according to my present invention by incorporating into the grits after their production or during the treatments carried out after removal of the shales a solution of carotenes and/or vitamin A in a vehicle compatible with the fat contained in the starchy portion of the cereal grains in question and consisting of a fat or lipoid or lipoid solvent. The finished or partially finished grit must be intimately mixed with the said solution. During the mixing operation and the subsequent storage the solution will dissolve into the fatty constituents naturally contained in the grits, with which the said vehicle of the carotenes and/or vitamin A must be compatible.

In the resulting product the carotenes and/or vitamin A obtains a property, of which it is not in possession before the addition thereof to the finished or partially finished grit, i. e. they obtain the property of being resistant to oxidative deterioration, because they are kept protected in the fat inside the grit particles and not absorbed to the surface of the grains. It has been found that the carotene or vitamin-A-oil present in the grits treated according to the present invention keeps well for at least 6–8 months, which would not be the case, when these easily deteriorable substances were under the influence of oxidising agents in or outside the grain.

Furthermore the oat meal has an antioxidising property acting in the same direction.

The antioxidising property of oats has been utilized before but in quite another manner. Thus finely ground oat meal has been incorporated into batches of the fat to be preserved, or it has been dusted upon the surface of fat-containing products having a tendency to develop rancidity, or the meal has been dusted upon the bags or wrappings, into which such products are packed.

According to my present invention, in contradistinction to these known appliances of the antioxidative properties of oat meal, the vitamin and carotenes to be protected against oxidation are introduced into the interior of the seed kernels or pieces, more or less crushed, of seed kernels of which the grits consist, being dissolved in the fatty contents of this substance. The protective constituents of the product are thus present in a very great excess over the substances to be protected, which results in an enormous increase in keeping qualities.

The nutritive qualities of the grits or groats produced according to the present invention may be further increased by intermixing the grits with minerals salts especially with calcium phosphate, for instance precipitated calcium phosphate $CaHPO_4$. It has been found that cereal grits, especially oat grits, without this addition, have a very undesirable rachitogenic influence on young growing animals feeded thereby, which influence may, however, be perfectly removed by the addition of the said salt or of other mineral salts or salt mixtures containing the calcium base and phosphoric acid in the same proportion.

With these general statements of the objects and purposes of my invention in view I will now proceed to describe the particular embodiment thereof and the manner in which my invention is carried out, and it will be understood that while I have described what may be considered as a preferable embodiment of my invention I do not limit myself to the precise conditions and proportions herein set forth as they may be varied by those skilled in the art in accordance with the particular purposes for which they are intended and the conditions under which they are to be utilized.

In carrying my invention into effect I may add to the grain from which the shales have been removed, a solution of carotene and vitamin A in arachide oil or another similar oil, and pul-

verous precipitated calcium phosphate $CaHPO_4$. The said solution will normally be added in such an amount that 1 gram of grit will contain 8–12 international vitamin A units, preferably half of them in the form of carotene and the balance as vitamin. The concentration must preferably be selected so that the grit must take up 1% or less of the oil in order to obtain the vitamin content desired. The exact concentration will then depend upon the porosity etc. of the grain. The amount of calcium phosphate is preferably 1% calculated upon the weight of the grain.

I wish it to be understood that I do not desire to be limited to the exact details and proportions described.

JØRGEN PETERSEN.

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ALIEN PROPERTY CUSTODIAN

MACHINE FOR KNITTING CABLE COVERINGS AND THE LIKE

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Application filed December 16, 1938

Pliant electric conductors having knitted tubular shaped coverings whose loops and knots encase the conductor spirally are not new. In knitting machines for the manufacture of such coverings, a cam cylinder and a bobbin disk are rotated at a rapid speed and this causes rotation of a needle cylinder in a manner which results in the twisting of the loops. Although the output of these machines is considerably greater with identical motive power, compared with that of a bobbin machine and greatly exceeds that of weaving machines with less power use, nevertheless this manner of knitting coverings and casings has been generally abandoned, and coverings are now made by knitting machines in which both the grooved cam and the bobbin disk remain stationary, but in which the needle operating cylinder is given a high rotating speed. This produces knitted coverings in which the loops run spirally around the conductor, while the knots form lines parallel to the axis of the conductor. Compared with the first mentioned coverings, the advantage here lies in a faster rate of production, since the disk carrying the material bobbins does not rotate and the rate of speed of the machine can therefore be increased, causing the coverings to have smoother surfaces. In such coverings, the length of each mesh depends, in addition to the diameter of the conductor and the feeding action, on the number of high points in the cam having a lock forming groove. If, for instance, four high points are provided in this groove, each needle produces at one rotation of the needle cylinder four stitches, so that therefore, each stitch misses the fourth part of the length of the band so produced during one revolution of the needle cylinder. Since in providing four high points in the groove, the diameter of the cam is about three times as great as the diameter of the cylinder head, the knitting of cables of greater diameter is limited because an increased diameter with a medium stitch length would require more than four high points in the groove, in which case the diameter of the cam would increase at a more rapid rate than the diameter of the cylinder head.

Should, for instance, the diameter of the cable to be covered increase by 1.5 mm and should the upward motion of the loops around the conductor, as well as the length of the stitch be held evenly, a number of additional stitches is required, depending on the diameter of the cable, as well as a like number of high points in the groove whose mounting in the cam cylinder would require an increase in diameter of 12.5 mm. This would result, however, in the forced shortening of the base of the needles engaging the cam groove against the needle shaft, which makes the guiding of the needles in the grooves of the cylinder unusually difficult, since with too great shortening, the needles wabble and offer great resistance to their guidance. To guide the needles by means of elements as, for instance, bi-armed levers, mounted between the base of the needles and the cam curve is impracticable because of involved construction. To be able, therefore, to knit coverings around cables of great diameter whose loops run spirally around the conductor and whose knots form parallel lines to the axis of the body, the cam cylinder of the machine, which prior to the present invention has been fixedly mounted, is given an increased number of rotations with respect to the needle actuating cylinder in such manner that the product of the number of stroke effecting cam points and a selected factor plus 1 gives a whole number which at the same time determines the number of the thread guides mounted on the needle cylinder and remaining fixed.

With the foregoing and other objects in view, the invention consists in the details of construction, and in the arrangement and combination of parts to be hereinafter more fully set forth and claimed.

In describing the invention in detail, reference will be had to the accompanying drawings forming part of this application wherein like characters denote corresponding parts in the several views, and in which:

Figure 1 is a vertical section to a portion of a knitting machine constructed in accordance with this invention;

Figure 2 shows a developed section, to an enlarged scale, of knitting effected by the machine shown in Fig. 1;

Figures 3, 4 and 5 illustrate schematically the action of a machine constructed in accordance with this invention, wherein the needle actuating cam cylinder has three high points and revolves once for each counter revolution of the needle cylinder;

Figs. 6 to 9 show schematically successive steps in the actuation of the machine of this invention, wherein the needle elevating cam cylinder rotates twice in an opposite direction to a single rotation of the needle guiding cylinder;

Figs. 10 to 13 show schematically an arrangement similar to that shown in Figs. 6 to 9, but wherein the number of needles is duplicated;

Fig. 14 illustrates schematically a development

of the knitting accomplished by the arrangement shown in Figs. 15 to 19;

Figs. 15 to 19 show schematically an arrangement similar to that shown in Figs. 6 to 9, but wherein the number of needles is quadruplicated;

Fig. 20 shows a further schematic arrangement of the invention;

Fig. 21 illustrates schematically a development of the knitting accomplished by the arrangement shown in Fig. 20.

The needle cylinder **1** (Fig. 1) which is provided with a bore for the insertion of the cable **2** having a somewhat greater diameter than the cable, is mounted in a casing **3** by simply fitting it thereon. Casing **3** runs in a casing **6** which carries a cam cylinder **4** and which is mounted in the frame **5** of the machine. The casing **6** has at its lower end a gear **7** engaging the gear **8** of a shaft **9**. On the shaft **9**, two gears **10** and **11** are fixedly mounted, and the gear **10** engages a gear **12** that is actuated by means of a motor not shown in the drawing. Gear **11** is removably mounted on shaft **9** and engages an idler gear **14** mounted on a swinging arm **13**. The gear **14** engages a gear **15** fixed on the lower end of the casing **3**. In order to change the length of the meshes, casing **3** is adjustable in height by means of a nut **16**. Thread guides **17** are fixedly mounted opposite the cylinder head.

To produce the mesh formation shown in Fig. 2 with six meshes on the diameter of the conductor for each needle, there was formerly required a cam with six high cam points which necessitated a comparatively large cam diameter, thus causing difficulties in the operation of the needles. According to the present invention, the same mesh formation is produced with only three cam high points by giving the cam cylinder a counter rotating movement to the needle cylinder, in such manner that in one revolution of the needle cylinder, the cam cylinder makes a complete counter revolution. If desired, the same mesh formation can be produced by providing two cam high points in the cam cylinder by giving the cam cylinder twice the number of revolutions of the needle cylinder in counter-rotative movement. To describe the operation of each knitting needle during the above mentioned counter-rotative movement of the needle cylinder and the cam cylinder, for simplification these will be described in a case where only one knitting needle is provided for each of the above mentioned three cam high points **18** in the cam cylinder **4**. As can be seen from Figs. 3–5, each knitting needle **19**, therefore, would be lifted, when the needle cylinder **1** and the cam curve rotate counterwise at even speeds, by a partial rotating movement of the needle cylinder at half the distance of two high points, through the cam high point **20** which has met it in the meantime (Fig. 4), so that the needle hook is lifted and lowered once and thereby forms a mesh. In the following partial rotation of the needle cylinder, the needle is again lifted by the following cam high point **20'** and a new mesh is knitted. Since three cam high points are provided, each needle is therefore lifted and lowered six times during each full revolution of the needle cylinder, i. e. six meshes are knitted. The path of movement of the needle hook has been shown in dotted lines in Fig. 3.

If only two high cam points **21** are provided in the cam cylinder **4**, the latter is rotated twice as fast counterwise as the needle cylinder, in order to produce the required number of meshes for each needle during one revolution of the needle cylinder. In the running of the machine, therefore, gear **11** must be exchanged for a gear with twice the teeth and the swinging arm **13** must be correspondingly adjusted to properly position idler **14**.

In Figs. 6–9, the mesh formation in this case is described in greater detail. When the knitting cylinder, together with needles **22**,**22'**, is moved in the direction of the arrow by one-third of the distance of the cam high points **23**,**23'**, the cam curve rotates twice, so that one of the needles **22** comes to rest on the high point **23'** of the cam and has therefore been lowered and raised once, forming a mesh. In the next partial rotation of the needle cylinder and the needle the same distance, the cam high point **23** of the second needle lifter comes to rest in the position of needle **22**, so that the latter is again lifted and lowered and forms a second mesh (Fig. 8). In Fig. 9, the position of needle **22** can be seen, in which the needle cylinder has made half a rotation and the cam cylinder a complete turn. Needle **22** has been advanced from the position of Fig. 8 by an additional third of the distance of the cam high points from each other and cam high point **23'** has arrived in the same place so that the needle is lifted and lowered a third time. During the described movement, the needle hooks of the needles **22**,**22'** have finished the course indicated in Fig. 6. At the cam high points of the course of the movement, the insertion of the thread in the hooks of the needles takes place, so that between two cam high points of the described embodiment, three thread guides are provided and in all, six thread guides **17** are shown.

In the embodiment of Figs. 3–5, only two thread guides are provided, corresponding with the course of movement of the needle hook for each cam high point. Since in this embodiment, however, three cam high points are provided, there results again a total number of six thread guides **17**. From the course of movement of the needle hooks shown in Figs. 3–5 and 6–9 can be seen that by means of the counter rotating movement of the cam cylinder, an apparent increase in the number of cam high points in the cam cylinder **4** results, that is in both embodiments six cam high points are effectively produced by one rotation of the needle cylinder, since each needle during one rotation of the needle cylinder is lifted up six times. Since in the first embodiment (Figs. 3–5) three cam high points are present in the cam, the factor for obtaining the six effective cam high points is "two." while in the second embodiment (Figs. 6–9) in which two cam high points are present in the cam cylinder the factor is "three". From the sum of the number of rotations of the needle cylinder and cam cylinder relating to one rotation of the needle cylinder, the above mentioned factor results. In the first embodiment, the number of rotations of the cam cylinder in one rotation of the needle cylinder is "one" and its sum "two", so that by three cam high points six apparent cam high points result.

In the second embodiment with two cam high points in the cam cylinder, the latter makes by one rotation of the needle cylinder, two counter rotating movements so that the sum is "three" and the number of the effective cam high points is six. In general terms, the equation is the relation between the number of movements of the cam cylinder and the needle cylinder increased by the value one.

Should instead of one needle a plurality of

needles be mounted for each cam high point in the cam cylinder **4**, the cam cylinder receives an increased number of rotations relative to that of the needle cylinder, depending on the number of the needles acting on each cam high point, in order that each needle may be brought into knitting action.

Fig. 10 shows a cam cylinder with two high points **24**, **24′**. For each high point there are two knitting needles **25**, **26** and **25′**, **26′**. The actuation of the cam cylinder follows in such manner that while the cylinder makes one complete rotation, the cam cylinder makes two counter rotating movements in harmony with the two needles riding on each cam section. The needles **25**, **25′** successively reach the high points after $\frac{1}{12}$ rotation of the needle cylinder (Fig. 11) and rest on the high points **24**, **24′** of the cam and are therefore lifted to receive the thread, while the needles **26**, **26′** are at the same time at the lowest points of the cam curve and form a mesh. In the next $\frac{1}{12}$ turn of the needle cylinder (Fig. 12) the needles **25**, **25′** reach the lowest points of the cam, while the needles **26**, **26′** are lifted by the cam high points **24′** and **24** for the reception of the thread. After a quarter turn of the needle cylinder and a half turn of the cam cylinder from the starting point in Fig. 10 to the point in Fig. 13, the needles **25**, **25′** are again lifted by the cam high points **24′** and **24** while the needles **26**, **26′** are again lowered. The heads of all the needles are guided in the path shown in Fig. 10 during the described part turn of the cylinder and the cam cylinder, so that each needle is lifted up six times and knits six meshes during a complete rotation of the needle cylinder. At each point at which the needles are lifted, a fixed thread guide **27** is mounted. When three, four, etc. needles are provided for each high point, the cam cylinder counter rotates thrice, four times, etc. as fast as the needle cylinder.

Knitted coverings with a circum-knitted formation (Fig. 14) in which the knots of one row of meshes form a zigzag line with the knots of the other meshing row, that is, knitted coverings which consist of two single coverings meshed into each other whose loops cover each other, can be made as known by means of two cam cylinders mounted within each other, whose cam curves show two staggered high and low points. The staggering must be so selected that with simultaneous drive of both cam cylinders the path of the movement made by the heads of the two needle groups forms two or more facing wave lines.

According to the invention, such coverings can also be made with only one single cam cylinder if an even number of needles is grouped for each stroke of the cam cylinder and if the cam cylinder opposite the needle cylinder is given a number of revolutions corresponding to half the number of the group of needles acted upon.

In Figs. 15–19 a cam cylinder is shown with two high points **28**, **28′** and in which in the needle cylinder a total of eight needles **29—32** and **29′—32′** are provided so that for each high point four needles rise in succession. When the cam cylinder receives double the revolutions of the needle cylinder, the needles perform as if each half of the needles had been mounted in two cams whose high points are staggered, as will be described further on. After a $\frac{1}{24}$ revolution of the needle cylinder from the position shown in Fig. 15, needle **29** comes from its deepest position to the intermediate position shown in Fig. 16, because of the counter rotation of the cam cylinder at $\frac{1}{12}$ revolution, while needle **30** goes from its intermediate position to its highest point. After an additional part revolution of the needle cylinder and the cam cylinder in the described proportion, needle **29** arrives at its highest point (Fig. 17) while needle **30** arrives at its intermediate position. Needle **31** which was at its highest position in Fig. 15 has in the meantime reached its lowest point, while needle **32** which was at its lowest point in Fig. 16 has arrived at its intermediate position. Fig. 18 shows the position of the needles after an additional part revolution of the needle cylinder and the cam cylinder in relative position. Needle **30** has now reached its lowest point while needle **32** has arrived at its highest position, and needles **29**, **31** are in the intermediate position. In Fig. 19, needle **29** has again arrived at its lowest point after a $\frac{1}{6}$ revolution from the starting position shown in Fig. 15 of the needle cylinder and $\frac{1}{3}$ revolution of the cam cylinder, that is it has been lifted and lowered and has so made a stitch. The other needles **30—32** are now in the same group position on the point **28′** as in Fig. 15. Needles **29′—32′** which stood on the point **28′** in like grouping in Fig. 15 complete, during the described part revolution to the position shown in Fig. 19, the same movements as needles **29—32**. Fig. 15 shows the course of movement of the needle hooks during an entire revolution of the needle cylinder, each needle is lifted and lowered six times, during which needles **29**, **31**, **29′**, **31′** and needles **30**, **32**, **30′**, **32′** each are held in one group, whose needle hooks describe identical paths, in which the paths of the two groups, however, are staggered. At the height of the movement, a thread guide is provided for each group, that is six thread guides **33** and **33′** for each knitting cover. Since the factor of the number of revolutions of the cam cylinder compared with the needle cylinder plus one makes "three" and two lifts are provided in the cam cylinder, each knitting cover has again six thread guides. The invention, therefore, makes a knitting cover as, for instance, shown in Fig. 14 with only one single cam cylinder by means of definite choice of needles in the cylinder, the number of lifts in the cam cylinder and the counter revolutionary speed between needle cylinder and cam cylinder, which cover consists, as known in the art, of two single knitted covers knitted into each other. In the presented embodiment, six needle lifters would be necessary in the cam cylinder if the usual rigid cam curves opposite each other were used, while the high points of these lifters would have to be movable. This would require also a comparatively large diameter of the cam cylinder.

If it is desired to make a knitted cover with more than two inter-knitted single covers, for instance, "n" covers, the number of knitting needles in the cylinder is selected to equal "n" times sum derived from the number of high points in the cam cylinder plus the integral ratio (whole number) between the number of rotations of the cam cylinder and the needle cylinder. The number of the locally rigid needle guides then is equal to "n" times the number of high points in the cam cylinder plus the number of knitting needles.

Under the same proportions, a knitted cover with "n" inter-knitted single covers can be produced, if the sum from the number of high points in the cam cylinder and the ratio plus 1 of the

number of rotations of the cam cylinder and the needle cylinder is an improper fraction and is not described above a whole number, to which, however, is added the advantage of a closer cohesion of the single covers, since each needle does not always take the thread from the same group of thread guides, but takes it alternately from two or more groups.

In the schematically shown embodiment of Fig. 20, the cam cylinder shows only one high point **34** and is counter-rotated with ½ rotation for each rotation of the needle cylinder, so that the two knitting needles **35**, **36** knit 1½ meshes at each rotation of the needle cylinder, that is in two rotations of the needle cylinder, the needles form three complete meshes. The arc of movement of the needle hooks which can be determined in the same manner as in the above described embodiments, shows that in this embodiment single covers are inter-knitted, in which needle **35** receives its thread in one rotation from the thread guide **37**, and in the second rotation from the thread guide **38**, while needle **36** receives at the same time the thread from the thread guide **39** in the first revolution and from the thread guide **40** in the second revolution. In the additional revolutions, the action is repeated. As can be seen from Fig. 21, four inter-knitted single covers are formed. The ratio plus one of the number of rotations between the cam cylinder and the needle cylinder is, in this embodiment, equal to 3/2. The numerator of this improper fraction shows that each needle is lifted three times for making meshes, while the needle cylinder makes two revolutions as indicated in the denominator. The number of knitting needles in the needle cylinder as well as the number of the locally rigid thread guide lifters can again be determined as in the embodiments of Figs. 15–18. Since four covers are produced and only one needle is present in the cam cylinder, the number of needles added to the "*n*" times number of needle lifters in the cam cylinder equals 6, that is there are present six locally rigid thread guides which must be mounted on those points where the knitting needles attain their highest position.

In the embodiments shown, the cam cylinder always makes a counter-revolution movement from that of the needle cylinder. To knit, however, by machines designed for knitting cables of the largest diameter, also cables of smaller diameter, the opposite effect can be attained, that the cam cylinder can be given a rotating movement in the same direction as the needle cylinder and in corresponding proportion in order to diminish the cam high points.

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3 Sheets-Sheet 1

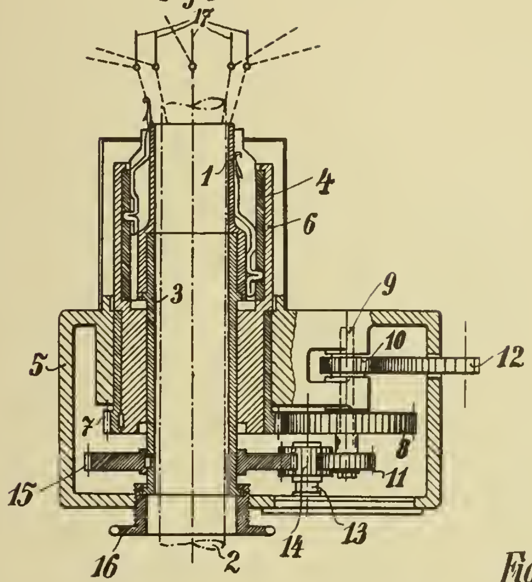
Fig. 1


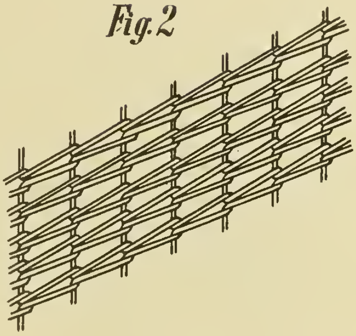
Fig. 2


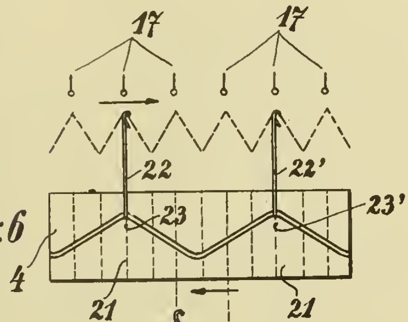
Fig. 6


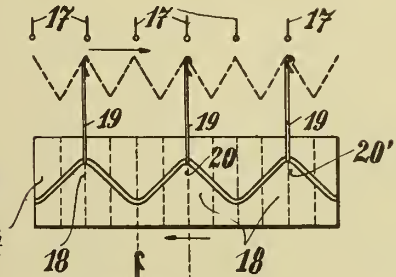
Fig. 3


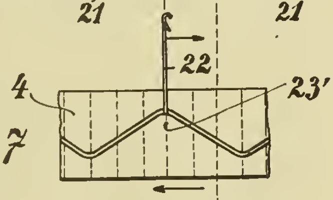
Fig. 7


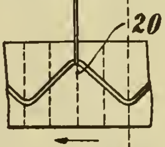
Fig. 4


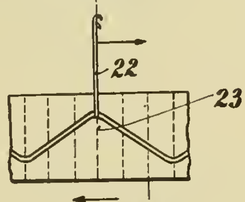
Fig. 8


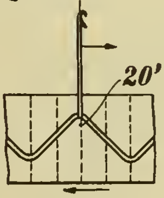
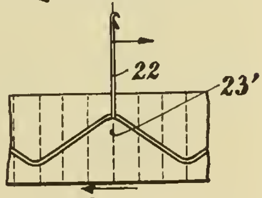
Fig. 5


Fig. 9


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3 Sheets-Sheet 2

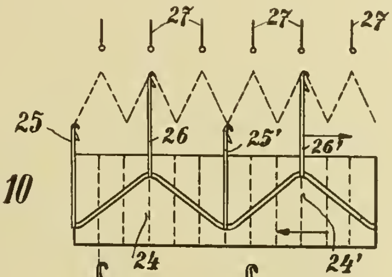
Fig. 10

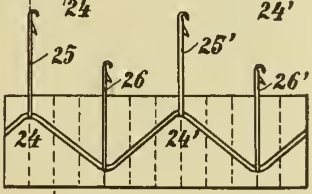
Fig. 11

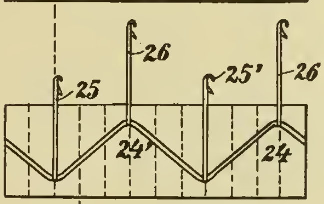
Fig. 12

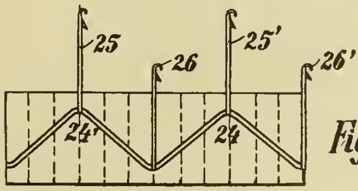
Fig. 13

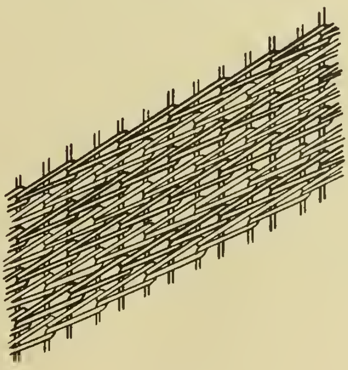
Fig. 14

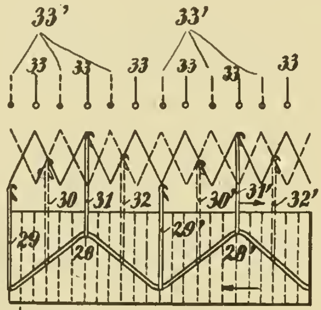
Fig. 15

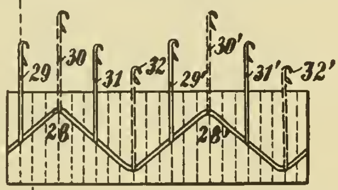
Fig. 16

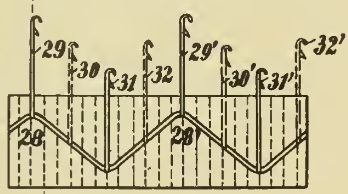
Fig. 17

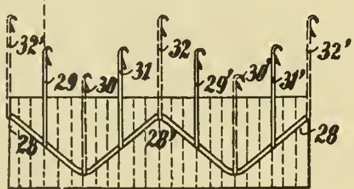
Fig. 18

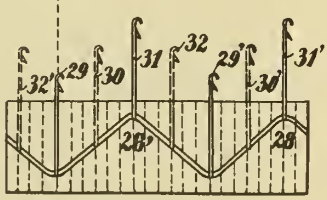
Fig. 19

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Fig. 20

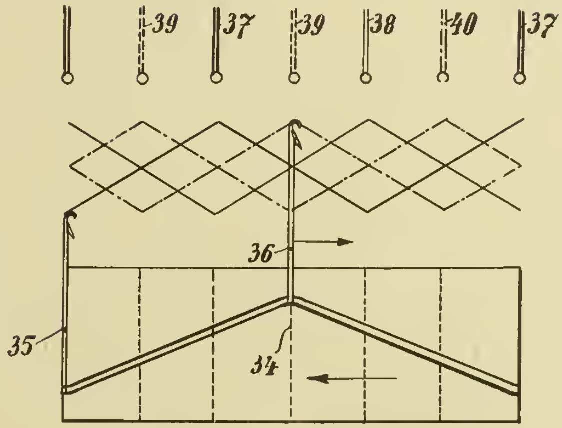
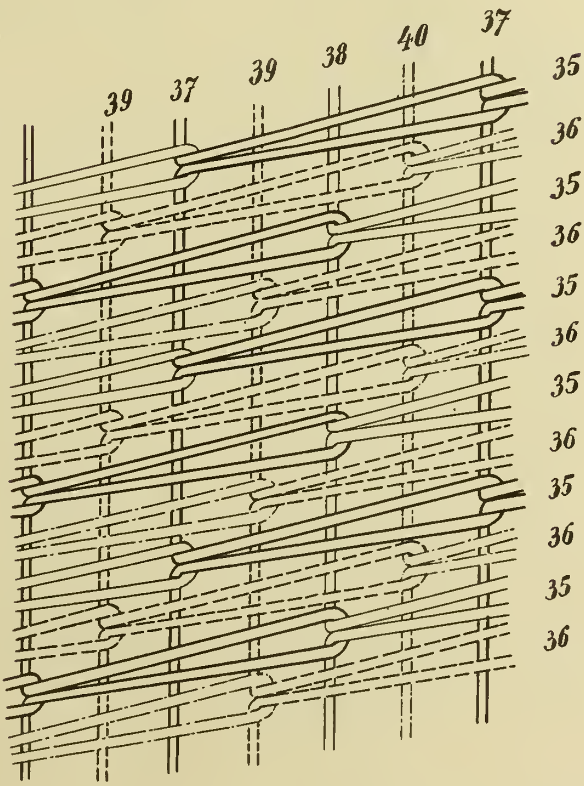


Fig. 21



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Published May 4, 1943

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ALIEN PROPERTY CUSTODIAN

SPRING RECOIL MECHANISMS FOR MACHINE GUNS

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Application filed December 24, 1938

This invention relates to spring recoil mechanisms for machine gun carriages of the kind having a soft recoil spring the ratio of the natural vibration period of which to the firing interval is about 2:1 to 3:1. With such mechanisms the gun during continuous fire does not attain equilibrium and firing takes place in a condition of fluctuation which has certain advantages but also disadvantages such as irregular firing and sudden excessive recoils.

It is an object of the present invention to overcome the disadvantages while retaining the advantages of firing in condition of fluctuating spring action.

An important feature of the invention consists in combining with a soft spring mounting having a natural vibration period greater than the firing interval, a brake mechanism and preferably a friction brake. This makes it possible to regulate the speed of the gun casing in a manner to produce a uniform firing sequence without affecting the magnitude of the recoil energy.

A soft spring mounting makes necessary a considerable structural length since the cradle has to accommodate not only the recoil spring, and according to the invention a brake mechanism, but also a run-out spring. To overcome this disadvantage, a further feature of the present invention consists in utilizing a part of the long recoil spring also as a run-out spring thereby diminishing the overall length of the assembly and saving material. For this purpose the part of the recoil spring separated therefrom for use as run-out spring is tensioned in the slide or in a member connected thereto in such a manner that during recoil one end of the spring finds an abutment against the tensioning member, while in running out beyond the zero position the other end of the spring is moved from the tensioning member.

In connection with this novel spring arrangement it is possible to take into account the requirement that the spring mounting of the carriage must function perfectly in all positions of the gun. Since on elevating the gun from the horizontal position and recoil spring mounting is loaded by the weight of the recoiling parts, according to the degree of elevation, the position of rest and the path of movement of the slide will be displaced backwardly on the cradle so that the guides of the carriage must be correspondingly elongated. In this connection the invention provides a further feature according to which the abutment of the recoil spring is displaced further forwards in the carriage with increased elevation of the gun whereby the spring tension is increased to provide compensation for the weight. For this purpose a telescopic spindle may be provided jointed at one end to the pinion shaft of the elevating mechanism and at the other end terminating in a rotary toothed plate the teeth of which engage with teeth on a tension rod engaging the abutment for the recoil spring in the cradle.

According to another feature of the invention a simpler arrangement can be employed by dispensing with adjustment of the abutment in exact correspondence with the elevation of the gun. The above mentioned parts may then be omitted, and the rear portion only of the recoil spring, when it attains a determined tension due to the elevation of the gun, is held fixed. The front buffer spring then serves alone to take up the remaining recoil energy.

It has been found, however, that the thus obtained weight compensation of the gun is not sufficient to remove all irregularities, and that it is necessary for quite exact firing also to relieve the members sliding to and fro inside the gun under spring action, from the action of the additional weight components, in firing with elevation or depression. According to the invention, the carriage spring mounting is used for this purpose in such a manner that during rocking of the carriage structure and the gun connected thereto in the vertical plane, the carriage spring mounting is tensioned not only corresponding to the weight component of the gun and slide assembly, but receives either in itself or with the aid of additional springs, a supplemental tension corresponding to the weight component of the internal movable parts, whereby also the variations in the movements in the internal parts of the gun are compensated, that is, also these parts return to their initial position always with constant speed.

The brake mechanism employed according to the present invention preferably consists of a friction brake and uniform firing of the gun according to the invention is best obtained when during the whole run-out a greater energy is dissipated in the brake than in recoil. It should be observed, however, that in the first shot of a continuous fire series the total recoil impulse is converted into recoil velocity, while in all following shots the recoil impulse is diminished by the residual run-out velocity of the immediately preceding shot. The braking force therefore must be greater in the first shot than in the following shots of a continuous fire series.

To this end a further feature of the invention consists in reducing the braking force after the first shot of each continuous fire series, to adjust said force to the reduced recoil energy. This results in smaller fluctuations of power between run-out and recoil. Two brakes are thus provided one of which is operative only during the first recoil and is then rendered inoperative, while at the end of the run-out after the last shot of the series it is again brought into action.

The automatic connecting and disconnecting of the second or auxiliary brake may be accomplished by means of the gun slide by disposing suitable stops in the path of the gun slide, said stops being connected with the brake.

Several constructional examples embodying the invention of the application are illustrated in the accompanying drawings in which:

Figure 1 shows a time distance curve of a continuous fire series in a gun having soft carriage spring mounting without braking, assuming perfectly uniform functioning of the gun.

Fig. 2 shows the same continuous but with the usually present irregular functioning of the internal parts of the gun.

Fig. 3 shows the continuous according to Fig. 2 with reduced time coordinate scale.

Fig. 4 shows the time distance curve of a continuous fire series in a gun with soft spring mounting in combination with a brake mechanism according to the invention.

Fig. 5 shows the result achieved by means of the invention compared with that of an irregularly operating gun as in the prior art.

Figs. 6, 7 and 8 show the upper carriage with slide containing a built-in spring mounting and brake, the views being respectively in vertical section, in plan and in cross-section at the line A—B of Fig. 6.

Fig. 9 shows an arrangement of the carriage spring mounting with the front portion of the recoil spring used as compensatory spring when the gun is elevated.

Fig. 10 shows the arrangement of a friction brake with different braking force in the two directions of movement.

Fig. 11 illustrates diagrammatically a gun with automatically variable spring mounting of the carriage according to the elevation of the gun.

Fig. 12 illustrates diagrammatically the arrangement of two brakes in the gun, one of which is put out of action after the first shot and restored to operativeness after the last shot of a series.

On discharge of the gun having a soft spring the natural vibration period of which has a ratio of 2:1 relatively to the firing interval, but in which no brake is present, the zero position, as will be seen in Fig. 1, is not again attained after the first shot, as long as continuous fire lasts. As already pointed out above, it is assumed in the case of Fig. 1 that the parts in the interior of the gun operate perfectly uniformly, which is never the case in practice. Actually there is always obtained a time distance curve like that of Fig. 2 from which it is clearly seen that the separate firings occur at quite different distances from the normal. Under these conditions the accuracy of firing naturally suffers.

From Fig. 3 which shows the conditions of Fig. 2 with reduced time coordinate scale, it can be clearly seen that the irregularity is propagated and persists during the whole series of continuous firing.

Fig. 4 shows the behavior of a gun in which according to the present invention a soft spring is combined with a brake mechanism. The soft spring must be so tuned to the firing interval that during the shots following the first shot of a series the gun does not return completely to the position of rest. The brake mechanism has to be so adjusted that on the one hand it regulates the speed of the gun casing in the direction of a uniform firing sequence, and on the other hand without braking the recoil energy of a discharge during a firing interval. In this manner even with non-uniform functioning in the interior of the gun, uniform movement of the gun relatively to the cradle is obtained and the movements of parts inside the gun and the gun casing are prevented from falling out of step with those of the cradle.

The conditions in a gun mounting of this kind are entirely different from those in a gun having a stiff spring mounting instead of a soft spring mounting and brake. With a stiff spring mounting movements inside the gun have no importance because the gun remains at rest during about two thirds of the whole firing interval, since the recoil and the run out terminate after a third of the firing interval. During the long period of rest the parts in the interior of the gun come to rest so that they have no effect upon the following shot. With a stiff spring mounting, therefore, the problems solved by the invention of the application, are not present. The advantages achieved by the present invention are particularly notable from contemplation of Fig. 5 which shows in superposed relation the previously described time distance curves.

Curve 1 which shows the ideal case of the spring tuned exactly to the firing interval shows that each shot is fired at the same height a before the equilibrium position of the gun.

If fluctuations in the periods of movements inside the gun take place, then according to curve 2 the shots are fired at different distances before the equilibrium position. It is assumed, for example, that the second shot is fired by a time Δ^ts earlier than in the normal case. After this shot there then occurs a violent recoil because the speed of the gun at the instant of firing was less than the normal. At the third shot the speed of the gun, on the other hand, is greater and the succeeding recoil is less violent.

If one now applies a brake mechanism according to the invention, there is obtained a movement according to curve 3 of Fig. 5. The brake retards the too-violent movement after the second shot and brakes the recoil energy not transmitted in the necessary proportion, so that the third shot will be fixed again in the normal position of the gun (height a). Afterwards the regularity of the shot-firing will be given.

In order to attain the result intended with the invention the gun may be arranged according to the example shown in Figs. 6 to 8.

The gun 1 is rigidly secured to the slide 2 moving to and fro on the cradle 3 of the carriage. The disconnectable connection of the slide 2 with the cradle 3 will be made by means of two pins 4, which may have a rectangular cross section, which pins 4 may be inserted into corresponding holes 5 of the sleeve 6 forming the movable abutment of the buffer spring 7 serving as recoil and run-out spring as well as of the recoil spring 8. Into the front end of the sleeve 6 completely enclosing the buffer spring the brake-cylinder 9 is rigidly inserted, and the buffer spring 7 supports against this brake-cylinder 9, a spring-plate 10 being in-

terposed. The rear abutment of the buffer-spring 7 is formed by a flange of the spring-guide 11, and this flange supports against a ring 12 of the sleeve 6 if the gun is running-out beyond the zero-position, in all other cases against the flange of the front-guide 13 of the spring 8. At the rearmost end the spring 8 supports against the flange 18 of the guide 19 being mounted on the supporting tube 17. The fixed connection of the supporting tube 17 with the cradle 3 is obtained by means of nuts 20 and 21 on both sides of the rear wall of the cradle.

In front of the springs 7 and 8 and internally of the brake cylinder 9 there is arranged on the supporting tube 17 a friction brake consisting of a brake lining 23, a solid bushing 24 with tapered contact surfaces, and a pair of actuating wedges 25 and 26. Externally of these parts lie sets of disk springs 27 and 28 which are tensioned on the supporting tube between the collar 14 and a sleeve 29 by means of a nut 30. By turning the nut 30 the tension of the disk springs and therefore the braking force is adjusted. To prevent unintentional turning of the nut a locking member 31 is provided which is pressed by a spring 32 into an internal groove in the nut 30. A pin 33 retains the spring 32 and prevents turning of the supporting tube 17.

The elevating gear for the gun comprises a toothed ring 34 on the cradle which is engaged by a pinion 35 on a shaft 36 journaled in the under-carriage. The pinion shaft 36 has jointed thereto the outer tubular member 37 of a telescopic spindle, the inner telescopic tube 38 of which terminates in a toothed plate 39 which is rotatably mounted on the pivot 40 of the upper carriage, below the cradle and its suspension. The toothed plate 39 meshes with teeth of a plate 41 which is slidable in a guide 42 and is connected by a tension rod 43 to the flange 18, whereby movement of the plate 41 brings the flange 18 against the guide 19 and displaces the rear abutment of the spring 8 forwardly. When the cradle is depressed from the zero position, then the tension rod 43 slides back freely in the dovetail groove of the flange 18 held by the nut 20, so that the spring tension is not changed.

The same result of modifying the spring tension can be obtained in a somewhat simpler manner as shown in Fig. 9. In Fig. 9 it is assumed that the gun is elevated and is recoiling. Instead of the parts 37 to 43 shown in Figs. 6 to 8 there is provided a tube 44 inserted over the supporting tube 17. This tube constitutes an extension of the rear guide 19 of the spring 8 and is arranged in the recoil path of the front spring guide 13. The distance between the front end of the tube 44 and the rear edge of the guide 13 is such that it never becomes zero in slide recoil during horizontal firing. It is only after the gun has assumed a determined inclination that the tube 44, on recoil of the slide, contacts with the guide 13 whereby the spring 8 then becomes inoperative. After this the buffer spring 7 alone is tensioned to completely take up the recoil energy. In this manner the advantage is achieved that in spite of the greater loading of the spring in elevation firing, the reciprocation of the slide relatively to the cradle remains substantially the same as in horizontal firing.

The friction brake shown in Fig. 6 is arranged on the supporting tube 17 of the cradle between two disk springs of equal strength. With equal angles of inclination of the actuating wedges 25 and 26, the friction force of the brake is the same in run out and recoil. Since the fluctuation forces on the carriage are less when the braking force is greater in run out than in recoil, it may be of advantage to resiliently mount on the supporting tube 17 only the actuating wedge 26 which is operative in recoil. This is achieved as shown in Fig. 10 by providing a helical spring 45 which abuts on the collar 14 of the tube 16 welded or otherwise fixed to the supporting tube 17. By using a spring 45 of suitable power and suitable angles of inclination of the contact surfaces between the wedges 25 and 26 and the solid bushing 24, the ratio of braking force in run-out and recoil can be adjusted as desired.

In the above-described examples, only the weight components due to elevation of the gun have been used to modify the spring tension, and according to the example shown in Fig.11, means are provided which take into consideration also the conditions in the interior of the gun and which provide a further increase of the spring tension to compensate for the altered conditions in the interior of the gun resulting from its elevation.

In this case also the gun 1 is mounted on the slide 2 of the carriage 3 and reciprocates with said slide during firing. On the slide 2 there is provided a projection 46 disposed between a buffer spring 47 and the slide run-out spring 48. The spring 48 abuts at its rear end against an abutment 49 which is adjustable in the axial direction of the spring and which carries teeth 50 on its lower face. These teeth engage a toothed segment 51 which is pivoted to a toothed ring 52 carried by the carriage 3. The toothed ring 52 is rotatable about a shaft 53 and is actuated by a pinion 54 to elevate the gun. The toothed segment 51 is connected with a fixed bracket 55 by means of a pair of links 56, 57 which lie at an acute angle to each other when the gun is in horizontal position. The link 56 moves about the pivot of the toothed segment 51 and is fixed thereto so that angular movement of the link 56 is accompanied by an equal angular rotation of the segment 51. If the gun is now elevated for oblique or high-angle fire, the toothed segment 51 on the carriage moves through a corresponding arc about the pivot 11. In this movement the links 56 and 57 diverge so that finally the abutment 49 of the carriage spring is correspondingly shifted forwardly. The gear ratio is such that the initial tension of the carriage spring is increased not only by the supplemental amount required to compensate the weight components rendered operative by elevation but also receives a further tensioning sufficient to eliminate the loading which would otherwise be caused by the internal parts of the gun as a result of its elevation.

The above-described mechanisms are capable of accomplishing the purpose of the invention in the second and following shots of a continuous fire series. During the first shot of such a series, however, different conditions are present and therefore the braking effort according to the present invention has to be greater than in the following shots. Means for achieving this are shown in Fig. 12.

As in the previous examples, the gun 1 recoils on the slide 2 in the carriage cradle. The brake, which operates as in the previous example, is illustrated by the brake lining 59 acted upon by a spring 58. It will be understood that by changing the tension of the spring the magnitude of the braking effort can be varied. For this pur-

pose the lower end of the spring bears against a bevelled abutment **60**, the bevel of which cooperates with a ramp **61** on a rod **62**. The rod **62** is provided at its ends with stops **63**, **64** extending into the path of movement of the slide **2**. In the position of rest, the rod **62** assumes a position in which it is pushed fully forwards so that the inclined surfaces **60** and **61** are in maximum engagement. After the first shot, and only after the first shot, the slide **2** strikes against the stop **63** and thus forces the rod **62** rearwardly so that the ramp **61** is withdrawn from below the bevel of the spring abutment, whereby the tension of the spring and consequently the braking effort is reduced after the first shot. After the last shot when the run-out is no longer interrupted by a further shot, the gun returns to initial position, that is further forwards than during continuous firing, in which position the slide **2** encounters the front stop **64** of the rod **62** and carries the latter forwardly under the inclined surfaces **60**, **61** are again in maximum cooperation. This restores the brake to condition of maximum braking effort, with which it is ready to operate on the first shot of the next series.

In the manner herein-before described the machine gun according to the invention is equipped with a soft spring mounting and a brake mechanism capable of giving in all cases uniform sequence of fire with resulting accuracy of firing.

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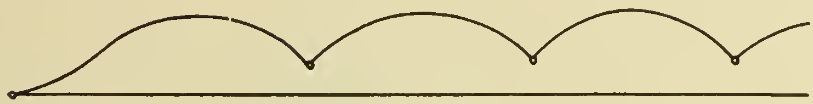


Fig. 2

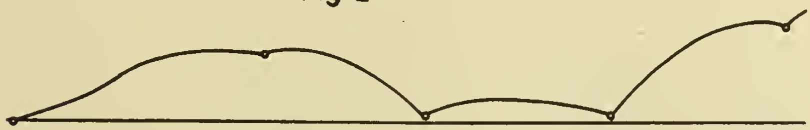


Fig. 3

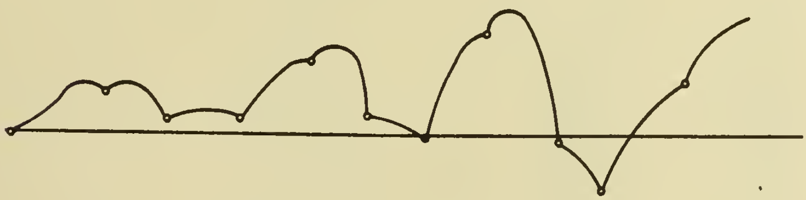


Fig. 4

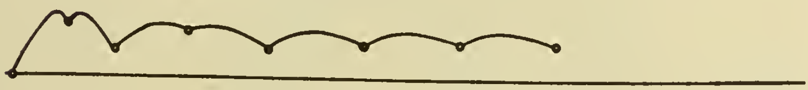
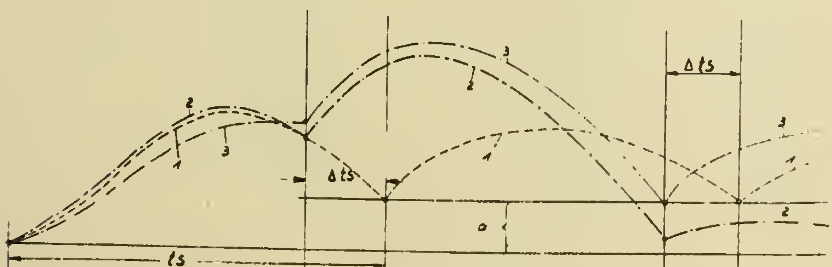


Fig. 5



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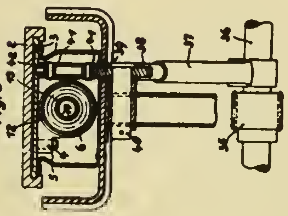
Fig. 8

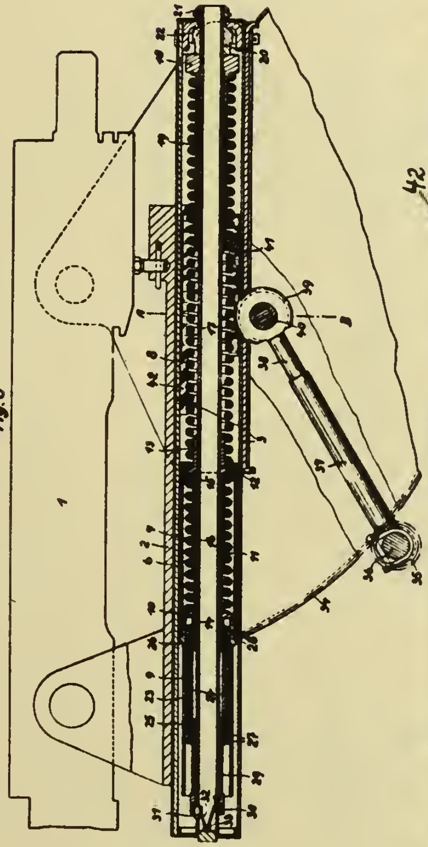
Fig. 6

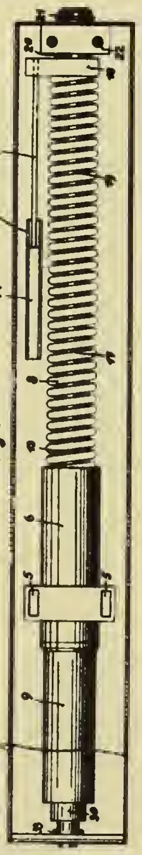
Fig. 7

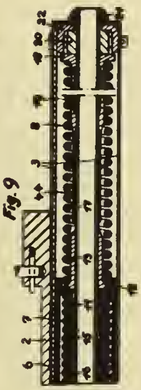
Fig. 9

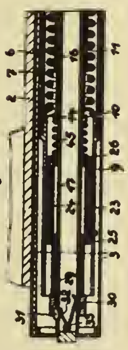
Fig. 10

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Fig. 11

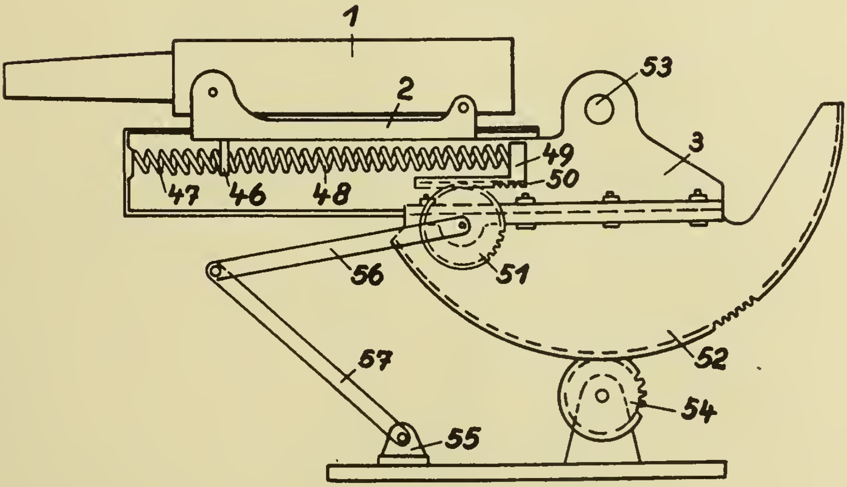
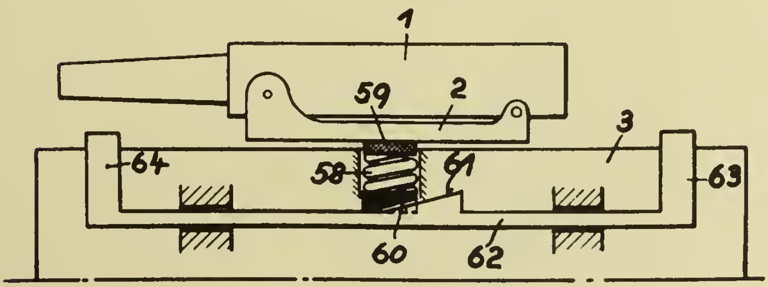


Fig. 12



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ALIEN PROPERTY CUSTODIAN

PROCESS AND APPARATUS FOR TREATING OR IMPROVING CELLULOSE MATERIAL

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The invention relates to a process and apparatus for treating or improving cellulose material and enables a greater yield to be obtained of a material which is specially suitable for the production of viscose and artificial silk.

The process according to the invention consists in that the material is maintained at a definite temperature and an adjustable pressure independent of the temperature and is treated in a plurality of successive stages with lyes containing only small quantities of caustic alkali or with water for washing, the water and/or the lye flowing continuously through the material until the lye has acquired the desired concentration of salts, alkali solution preferably in concentrated form being added between each stage to bring the lye to the concentration necessary for treating the raw material.

The lye is allowed to flow through the material until it becomes so rich in salts that their recovery becomes economical. The raw material is treated with lye of maximum strength and the finished or nearly finished material with weak lye or water. In order to obtain the best effect, the material is treated at each stage with lye of only slight causticity while the total causticity used for the complete treatment has the usual value.

The lye concentration is kept below a value considerably influencing the viscosity of the cellulose solution to be obtained. The causticity of the strongest lye solution is almost completely utilised and the solution is rapidly removed from the material and can therefore not affect its bleaching capacity. The material is washed in the absence of air, oxygen or carbon dioxide since it is not transferred from the boiler to a separate washing plant, thus avoiding heat losses and chemical or mechanical damage due to rubbing on the walls of pipes, and destruction of the fibres by sudden expansion after the release of pressure.

The process according to the invention is described hereinunder by way of example with reference to the accompanying drawings but it is to be understood that the invention is not limited to the particular details set forth therein. In said drawings:

Fig. 1 is a general diagrammatic view of a plant according to the invention;

Figs. 2 to 5 represent diagrammatically various stages of the process effected by means of the plant of Fig. 1.

The plant shown in Fig. 1 comprises a set of nine boilers K1—K9, each boiler being provided with a pre-heater V_1—V_9 for heating the water or lye flowing therein to the best temperature for the particular stage of the material being treated.

Each boiler further comprises supply means A for adding alkali lye in adjustable quantities to the water or lye from a common pipe D, connections for the lye, washing water and waste water piping to a common ring piping B, and a pipe C which is connected to a washing water supply E fed by a pump F and which is connected to conduits L and P. At the end of the latter is located an automatic regulating valve N by means of which concentrated lye flowing in pipe P can be conveyed either to the regenerating station or through pipe L to any desired boiler.

The pressure of the water supply may be regulated by means of a compressor so that it is always slightly greater than the pressure in the boilers. Dosage pumps are advantageous for use as supply means A.

Fig. 2 represents one stage of the process at which the material is being distintegrated in five boilers **5**—**9**, and boilers **3** and **4** are used used for washing. The boilers **3**—**9** are connected together through valves *j*, *o*, *p* and preheaters V (Fig. 1), and are traversed by washing water for boilers **3** and **4**, and by lye for boilers **5**—**9**. The water for boiler **3** flows from pipe C through its corresponding preheater V_3 and alkali is added through supply means A to each boiler **5**—**9**, the concentrated lye flowing from the last boiler **9** through valve *m*, pipe P, and valve N to the regenerating station. The quantity of lye leaving boiler **9** is of course equal to the quantity of water which enters boiler **3** and the pressure of supply E thus governs the whole system.

The partly or completely treated material in boilers **5**—**9** is denoted by vertical hatching, the material in boiler **5** being almost completely disintegrated and that in boiler **9** being at the first stage of treatment, the intermediate boilers **6**, **7**, **8** being at intermediate stages. Boilers **3** and **4** contain finished material and are supplied with washing water only but after boiler **4** alkali is added through supply means A in an amount sufficient for completing the last stage of the treatment of the material in boiler **5**. Similarly alkali is added between each of the following boilers in amounts sufficient to complete the appropriate stage of treatment.

The lye gradually increases in concentration of salts from boiler to boiler and is of maximum concentration or density when leaving boiler **9**. The gradually decreasing disintegration stages

of the material and increasing lye concentration from boiler **5** to boiler **9** is represented by different thicknesses of vertical hatching. When the material in boiler **2** is completely boiled and washed it is removed by pipe X. Boiler **1** is filled with raw material.

When the lye in boiler **9** is of sufficient strength it is removed through valve N until its density falls below a certain value dependent on the amount of dissolved salts, when it is again treated with alkali and led to boiler **1** (Fig. 3), for treating a fresh batch of material, the lye flowing from boiler **9** through valve *m*, pipe P, valve N and thence to boiler **1** through valve T, pipe L, valve *r*. The addition of alkali to the lye is effected through a cock W by means of which an exactly predetermined amount of alkali can be conveyed from pipe D to pipe L.

The quantity of lye removed from boiler **9** is replaced by an equal amount of fresh lye at boiler 5 (Fig. 2). In Fig. 3 the material in boiler **5** is completely treated and the addition of alkali between boilers **4** and **5** is stopped, only washing water being now supplied to boiler **5**. When boiler **1** is filled with concentrated lye, boiler **5** is supplied with water and the lye in boiler **1** takes salts from the raw material therein and will be ready for regeneration.

The next stage of the process is represented by Fig. 4 which shows a system similar to Fig. 2 except that it has been displaced by one boiler towards the right-hand side. The material in boiler 3 is washed and removed through pipe X and boiler 2 is filled with a fresh batch of raw material. The treatment then continues as described with reference to Fig. 2, boiler **2** being supplied eventually with concentrated lye from boiler 1 as shown in Fig. 5 which represents a stage similar to Fig. 3 but displaced by one boiler to the right.

The process is then continued, the system following the sequence of Figs. 2, 3, or Figs. 4, 5, this sequence being repeated five times until the material in boiler 9 (Fig. 2) has reached the completed stage of the material in boiler **5** (Fig. 2). In the stages corresponding to Figs. 2 and 4 the concentrated lye flows to the regenerating station and a boiler containing the finished material is disconnected and emptied. In the stages corresponding to Figs. 3 and 5 a boiler filled with a batch of new material is put in the circuit, filled with lye and the supply of alkali is cut off from the boiler containing the finished material, the amount of concentrated lye drawn off being replaced each time by the addition of fresh lye.

The time required for the treatment of Figs. 2 and 4, or Figs. 3 and 5 depends on the material treated and the number of boilers. It may be calculated as follows:

If the material is to be completely treated in 5 hours and five boilers are used for successive stages of treatment, one stage, i. e. from the stage of Fig. 1 to Fig. 3, requires one hour. During this time the steps represented by Figs. 1 and 2 must be effected as well as boiler filling and lye removal. If the boiler capacity is 40 cubic metres and the lye removal 20 cubic metres, this gives a total of 60 cubic metres or 1 cubic metre/min. Lye filling of 40 cubic metres thus takes 40 minutes and the lye removal 20 minutes. The total boiling time is 5 hours and the washing time 2 hours if two boilers are used for washing.

If it is desired to complete the boiling in 4 hours and to use 6 boilers, each stage takes 40 minutes. For a boiler capacity of 40 cubic metres and lye removal of 20 cubic metres, the boiler filling takes

$$\frac{40\times 40}{60}=26.6 \text{ mins.}$$

and the lye removal 13.3 mins.

If according to the usual known alkali processes, raw material is treated, bleached and dissolved in an ammonia solution of copper oxide, the viscosity is at most 50, whereas with the process according to the present invention viscosities of 500–1,000 are obtained. Wood, for example pine or deal when treated by the process of the invention gives a viscosity of 200 and more with a maximum bleaching capacity. The chlorine necessary for obtaining a high whiteness value amounts at most to 1–2% of the dry material.

The process of the invention is also more profitable than the hitherto known methods. For pine or deal a yield of about 40% can be obtained whereas the usual process with a chlorine consumption of 2% gives a yield of only 35%. The strength of the material is also increased.

In addition to disintegrating raw material the process is also suitable for improving cellulose material. Hitherto for example sulphite material has been treated with a weak caustic soda solution, boiled and washed or subjected to similar after treatment. This requires large quantities of water which hold only small quantities of soda and salts the recovery of which is uneconomical. The quantity of sodium salt is, however, so great that the spent lye cannot be discharged into a river or canal. On the other hand according to the invention by using a series of boilers the lye is made so rich in sodium salts that the economical recovery of these salts is rendered possible.

RICHARD JENKE.

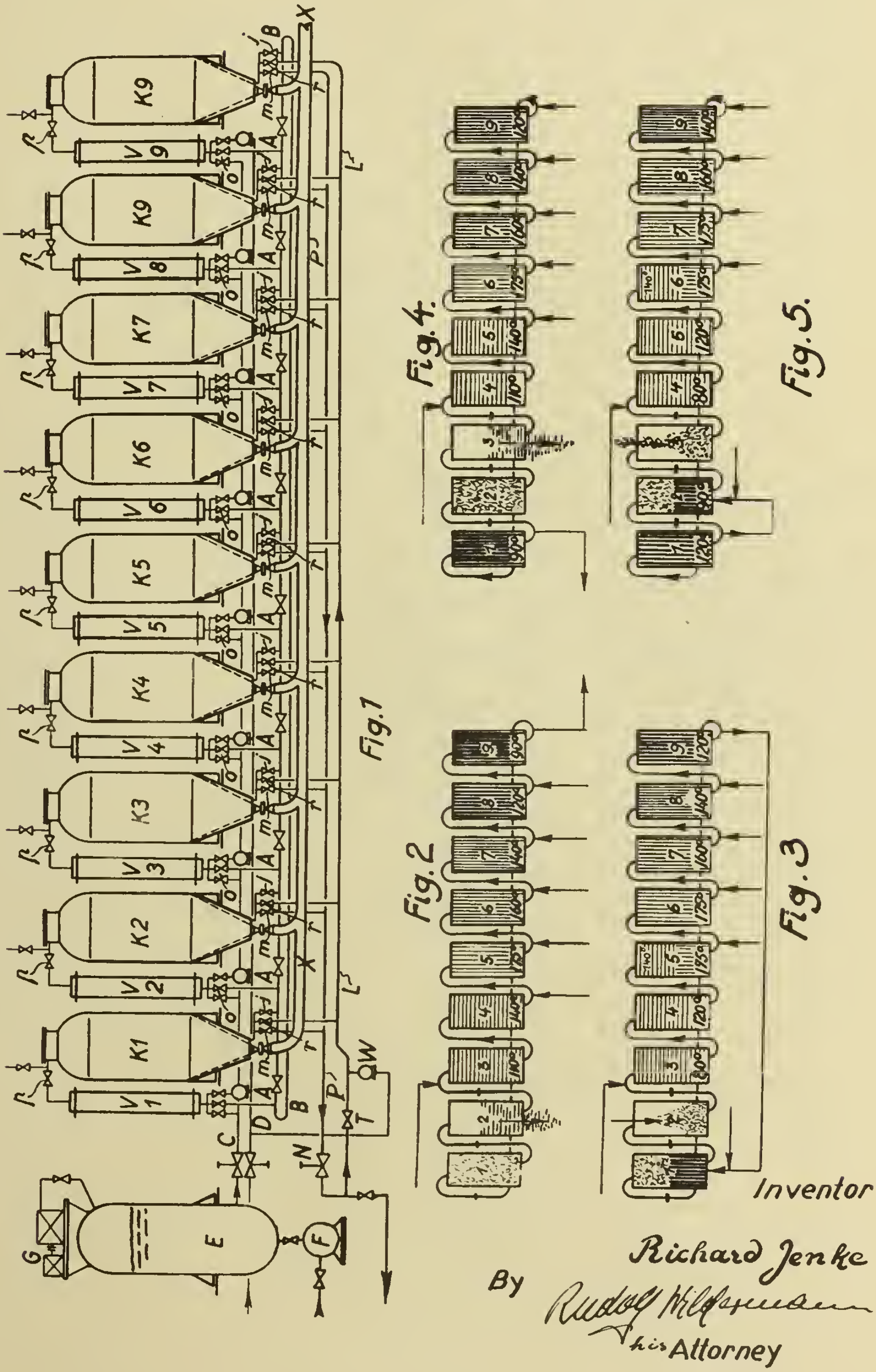
PUBLISHED

MAY 4, 1943.

BY A. P. C.

R. JENKE
PROCESS AND APPARATUS FOR TREATING OR
IMPROVING CELLULOSE MATERIAL
Filed Dec. 27, 1938

Serial No.
247,889



Inventor

Richard Jenke

By Rudolf Hildermann

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Published May 4, 1943 Serial No. 248,628

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF BLEACHABLE STRAW HALF STUFFS AND STRAW PULPS

Kurt Hess and Max Ulmann, Berlin-Dahlem, Germany; vested in the Alien Property Custodian

No Drawing. Application filed December 30, 1938

This invention relates to the production of bleachable straw half stuffs and straw pulps.

It is known that in the decomposition of short-fibred types of straw of high silicate content, it is not possible to replace the customary boiling lyes containing caustic soda by the cheaper lime lye, because the lime compounds of the non-cellulosic constituents of the straw are not sufficiently absorbed by the boiling lye, but remain in part in the stuff.

It has now been ascertained in accordance with the present invention that the lyes containing calcium hydroxide (milk of lime) it is possible to decompose the most diverse types of straw to form a high grade cellulose, if the action of the lye is followed by a thorough washing of the boiled material, accompanied by mechanical unravelling, for example in a grinding hollander or in an apparatus acting in a similar way to a grinding hollander (rod mill, edge mill, and the like).

During the boiling of the straw with milk of lime, pentosans and lignin-like constituents are mainly dissolved, while during the washing and unravelling those fibre constituents are washed away which were previously a hindrance to the further treatment of the products obtained by lime decomposition.

In the present process for the production of a high grade straw pulp two stages are thus involved, the first stage consisting of the preparatory treatment of the chopped straw with lime, and the second stage of the supplementary withdrawal of those straw constituents which were retained by the fibre, in consequence of insolubility in the boiling lye, during the lime treatment. During the unravelling by the mechanical treatment, these insoluble constituents are separated in a form particularly favourable to their separation from the fibre, since they are produced in the form of sludge, i. e. in extremely fine grains, which passes through the sieve during the rinsing in the grinding hollander, while the fibres are held back by the sieve, if the latter is suitably selected.

KURT HESS.
MAX ULMANN.

Published May 4, 1943

Serial No. 249,225

ALIEN PROPERTY CUSTODIAN

DEVICES FOR THE SELF-MOORING OF MINES AND BUOYS

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Application filed January 4, 1939

In the self-mooring of mines and buoys, generally, after their launching in water, the case of the mine or buoy remains floating, whilst a body of proper weight, called a "sinker" sinks towards the bottom. The connection between the case and the sinker is secured by a mooring rope or chain which unwinds from a mechanism, generally contained within the sinker, by a length corresponding to the increasing distance of the sinker from the case. Under the sinker, at a distance generally adjustable as desired, is suspended a sounding line. The operation of the latter is counteracted by a spring or other antagonistic force, whose action prevails only when the sounding line comes to bear against the bottom, so as to stop, eventually with a certain delay, any further unwinding of the cable. The mooring is thus obtained by the fact of the connection of the case with the sinker by means of a mooring length which now remains unvariable. As a particular case, otherwise very important, one can have also buoys and mines moored at any desired depth under the level of the water, when the sounding mechanism has been pre-arranged so that the unwound length of mooring cable will be less than the sounding by a length corresponding to the desired depth of immersion.

The mooring cable or chain, generally unwinds by rotation of the drum on which they are wound. Instead, according another known construction (U. S. Patent N. 1,910,988), said drum is fixed and is secured to the bottom of the sinker and over the drum is placed a rotatable arm pivoted on the axis of said drum. The cable coming from the drum is guided to the end of the arm, projecting outside the drum's flange, then the cable leaves the arm near the pivoting axis of the same, to connect its end to the case of the mine or buoy. When the drum sinks towards the bottom, said arm revolves, always keeping its extreme end outside the drum from which at every revolution it unwinds a turn of the cable. Now, instead of placing, as shown in above cited U. S. Patent N. 1,910,988, the drum at the bottom of the sinker and the arm over the drum, according to the present invention, said arm is pivoted at the bottom of the sinker and the drum is fixed to the sinker above the arm. The cable is always guided at the end of the arm and its end is brought into fixed relation with the buoys or mine's case, but after passing inside the drum. Thus it is possible to make use of the whole height of the drum to place the cable's stopping mechanism, without causing said cable to follow round-about circuits. Both these advantages are very great, particularly due to the requirements of the utmost saving in space necessary in such apparatus. Further, according to the present invention, the action of the spring or of other antagonistic force on the sounding line, is used for obtaining the stoppage of the cable either directly or indirectly. In the latter case, said force or counteracting spring limits its action in the blocking of the cable, to the starting of the intervention of a more powerful energy, as for instance that of the rotating arm or that of the cable that unwinds or of other members set in motion by said cable, or else also the energy of a proper spring preceedingly wound. Moreover over this intervention of an auxiliary energy, according to the present invention, can be obtained by making use of the same rotating motion of the arm unwinding the cable. For instance, with said arm a disc might be set in rotation, but in such a way, that, while said arm goes on revolving, the disk may be stopped at any moment, due to an arresting member which may engage in notches or teeth or other devices, regularly distributed in a certain sequency and frequency on the disk itself.

Said stopping member enters into operation due to the antagonistic spring of the sinker, as soon as the latter strikes the bottom. But, though stopped, by being coupled to the arm by means of friction or any other detachable coupling, the arm can go on revolving and the relative motion of the arm with respect to the disk may be made use of in many different manners, to start the auxiliary energy which will block the mooring cable.

The attached drawings show, by way of example, a few practical embodiments of the present invention.

With reference to the drawing in upright section, Fig. 1 and to the plan view of the same, along section *s—s*, with drum removed, Fig. 2, we will name:

t the case of the mine or buoy;
a the automatic sinker of the mine or buoy;
S the sounding line;
b the drum on which is wound the mooring cable;
f the mooring cable;
f_s the sounding line cable;
m the antagonistic spring of the sounding line;
t_r the rotating arm unwinding the cable;
G the jaws for gripping the mooring cable, with conical outer seat;
M the jaw-tightening member with inside conical seat;
l the sounding-line lever;

i the links connecting the sounding line lever to collar C;
C the collar;
p the pins projecting from the jaws-lifting plate;
h slots cut in member M allowing a vertical shift of pins p;
p_1 plate for lifting the cable-lifting jaws;
a_s rods to prevent the turns of cable from falling from the drum;
b_1 links carrying rods a_s and connecting them to the rotating arm t_r;
m_0 springs conferring yieldability to the rods a_s against the cable winding drum.

By leaving unaltered the meaning of the above symbols, as referring to members which do not undergo any change and with reference to the drawing in side view of fig. 3 as also to the plan of the same, along section u—u in fig. 4, we will name:

e the lever of the sounding line;
d the toothed disk;
f_h the thread by which the male piece M engages the female part of the disk;
o the box solid with d for lifting the pins p.

By leaving again unaltered the meaning of above symbols as referring to members which remain unaltered in the various alternatives and and with reference to the drawing in upright section fig. 5 and to the plan view of the same, along section u—u in fig. 6, as also to the details in section figs. 7 and 8, we will name:

n the bush solid with disc d;
q the pins fixed to member M engaging in the slots r of bush n;
r the slots in the shape of a reversed L cut into bush n for pins q;
v an auxiliary spring for helping the arrangement of the mooring cable; turns on the drum;
z horizontal slots in bush n allowing the swinging of pins q with M;
x cut in the slots r for resting-in pins q.

When the apparatus shown in fig. 1 is launched in the water, the case t remains floating on the surface, the sinker a sinks towards the bottom; cable f is thus pulled and compels arm t_r to rotate unwinding from drum b the cable f in a length corresponding to the gradually increasing distance between case t and sinker a: meanwhile the sounding line S with its weight keeps lever l down, notwithstanding the action of the antagonistic spring m. As soon as the sounding line S strikes the bottom, spring m prevails and lifts the lever l and with it the links i, collar C, pins p; and plate p_1 which lifts the jaws G forcing them in the cone M. Due to the inside conical surface of member M and to the outside similar conical surface of jaws G, the latter grip cable f, sliding between said jaws, and block it, preventing any further sliding of the mooring cable.

From this moment case t will be compelled to follow down the sinker a in its motion of descent, until the latter strikes the bottom.

According to figs. 3 and 4, as soon as the sounding line strikes the bottom, spring m lifts lever e whose tail engages one of the teeth regularly distributed with a certain frequency on the rim of disk d. The disk thus ceases to turn, whilst the arm t_r goes on revolving, but, due to the thread f_h connecting member M to disc d, this member will be lifted, dragging along box O and with it pins p, plate p_1 and the jaws which will block the cable as said above.

According to figs. 5, 6, 7 and 8, as soon as the sounding line S strikes the bottom, as stated above, the tail of lever e stops the disc d, forcing pins q, compressed by spring v in the slots x, to come out. Member M goes on revolving and with it, pins q fixed thereon. As soon as pins q reach the vertical part of slot r, spring m pushes upward bush n and with it pins p, plate p_1 and the jaws G which grip cable f as shown above. Eventually pins p can be fixed directly to the single jaws G; bush n will have also horizontal slots z allowing pins p to swing therein, whilst the bush is at rest. Member M on its turn will be provided with vertical slots h allowing pins p to be lifted for blocking the cable.

No particular difficulty prevents the achievement of many other embodiments of the present invention, and it would offer no difficulty, for instance, to obtain a gripping of the mooring cable with a spring as shown in figs. 5, 6, 7 and 8, making however bush n solid with member M, no more by means of pins q engaging in slots r, but with a thread f_h as shown in figs. 3 and 4. A bond of this kind might be convenient when the gripping of cable f is to be obtained after the rotating arm t_r has made with member M, a certain number of revolutions, as many as are required to disengage entirely the threads (which might be even somewhat long).

This arrangement is particularly convenient when the gripping of the cable is to be obtained when the sinker has laid on the bottom and a certain preestablished free run of cable is to be allowed for the mooring.

It should be borne in mind that according to the present invention, all the devices specified above, may be used in combination with special rods a_s, shown in figs. 1 and 2, secured to rotating arm t_r and which revolve with it, gliding against the flange of the cable drum b, to the object of preventing cable f from falling from the drum when slackening. Any of the rods a_s which can be in any desired number, may be carried by a link b_1 pinned to the arm t_r and may be connected to the said arm by a spring m_0 securing the yieldability of the bearing of rod a_s against the cable drum.

The invention shown above, can be used in combination with all and any other device which may be deemed most useful to the best performance of the buoys and mines. We will mention for instance those concerning the adjustment of the distance of the sounding line from the sinker, from zero to any desired value. We will mention the devices for temporarily blocking the mechanism for gripping the mooring cable, just for the first instants of the sinking of the sinker. Said block in the present case can be obtained in a particular easy manner by preventing the sounding line lever to move along its whole length necessary for obtaining the stoppage of the cable until the rotating arm t_r has not accomplished a certain number of revolutions, adjustable at will.

We will mention finally the application of a swivel or of a spherical joint to the attachment to case t of the mooring cable f.

ENRICO OLMO.

PUBLISHED

MAY 4, 1943.

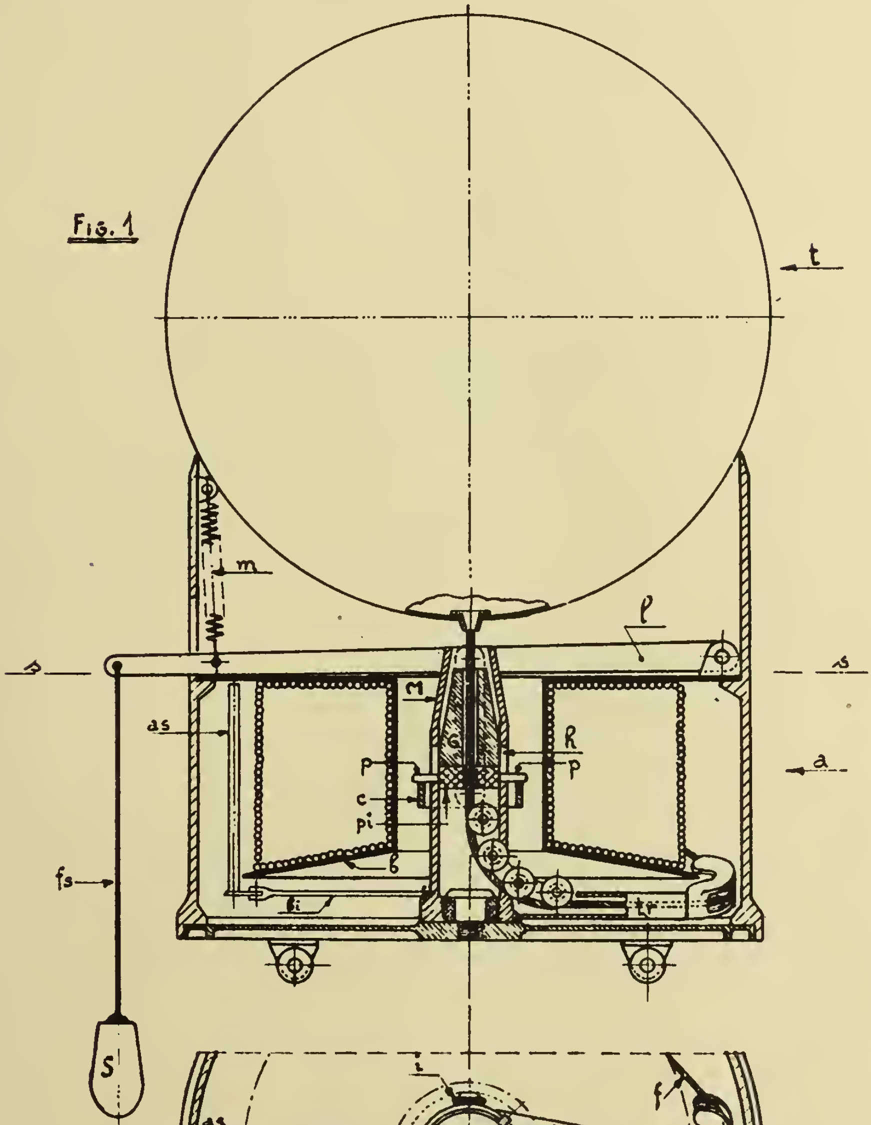
BY A. P. C.

E. OLMO
DEVICES FOR THE SELF-MOORING OF
MINES AND BUOYS
Filed Jan. 4, 1939

Serial No.
249,225

3 Sheets-Sheet 1

Fig. 1



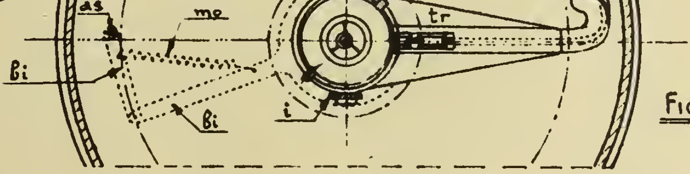


Fig. 2

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PUBLISHED

MAY 4, 1943.

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DEVICES FOR THE SELF-MOORING OF
MINES AND BUOYS

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Serial No.
249,225

3 Sheets-Sheet 2

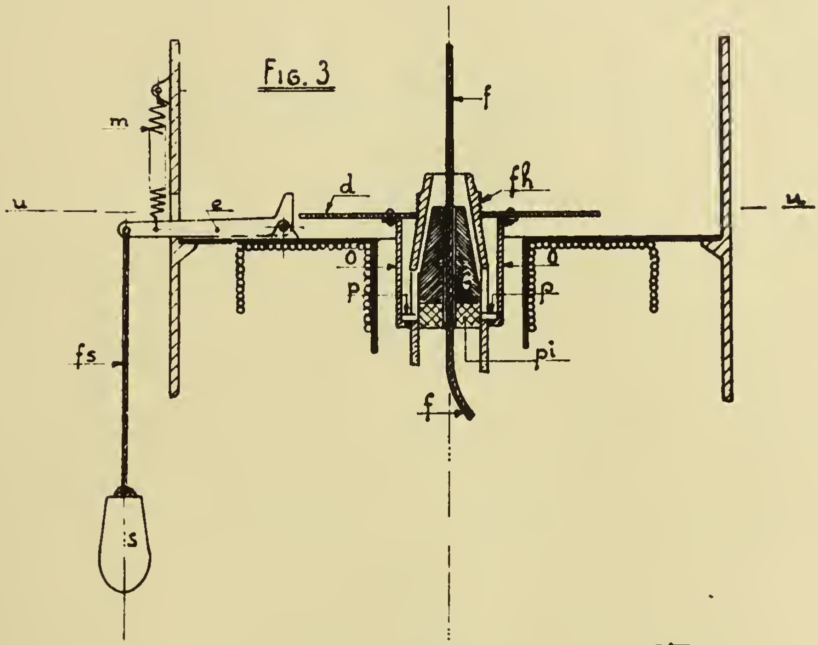

Fig. 3

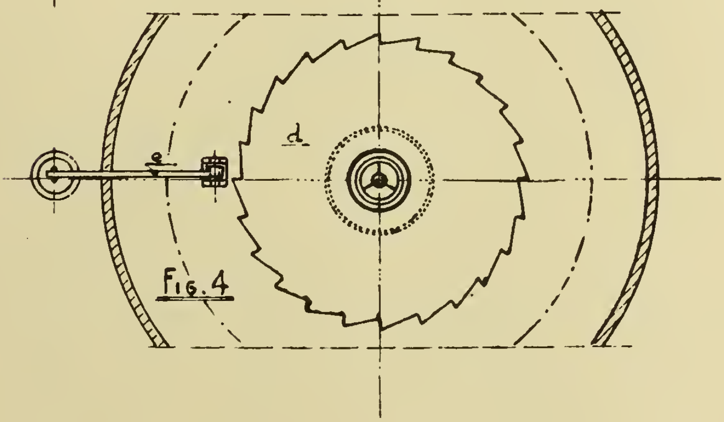

Fig. 4

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249,225
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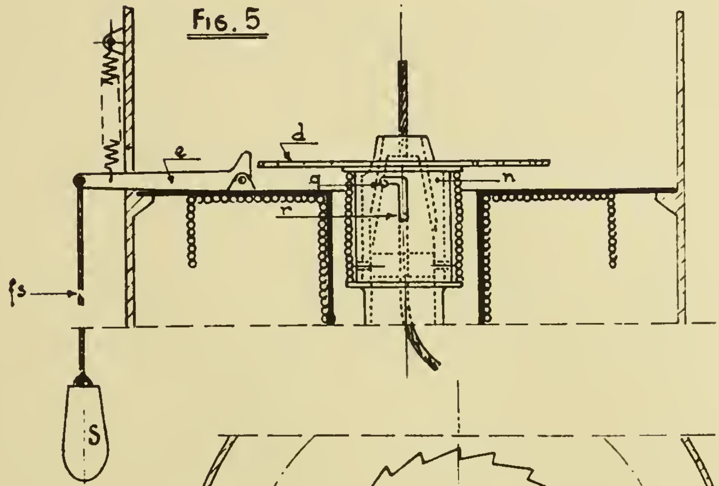
Fig. 5



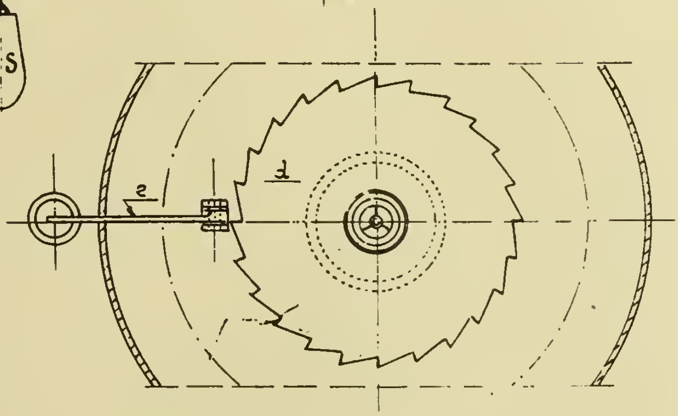
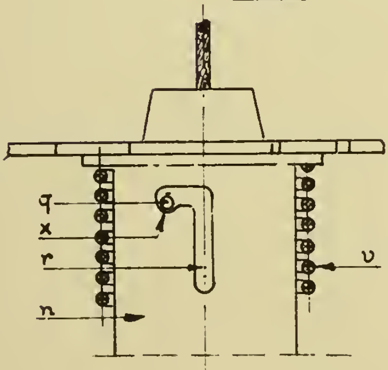


Fig. 6

Fig. 7



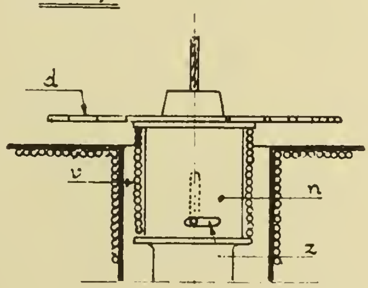


Fig. 8

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Published May 4, 1943 Serial No. 250,209

ALIEN PROPERTY CUSTODIAN

ARMOUR PIERCING PROJECTILES

František Janeček and František Karel Janeček, Praha-Nusle, II, Czechoslovakia; vested in the Alien Property Custodian

Application filed January 10, 1939

In a prior invention of the same applicants there is described a firearm having a barrel which is provided with an addition in which the projectile, the calibre of which corresponds to the bore of the barrel, is altered to a projectile of smaller terminal calibre. The advantages of this construction are explained, which construction is particularly important for weapons of high initial velocity of the projectile, since it permits a considerable shortening of the barrel, the formation of a suitable shape of projectile, and of the charging space and a better utilisation of the explosive charge whilst retaining the shape of the end of the projectile as ballistically advantageous as with ordinary projectiles. Various alternatives of the projectile and of the corresponding added parts are also described.

The present invention relates to the armour piercing projectile which varies in the conically shaped addition to the barrel from the original calibre to the final calibre and the construction of which is further developed as compared with the description of the invention hereinbefore mentioned in such a manner that, on the one hand, the shape of the end of the projectile is substantially complete and, on the other hand, its production is as easy and cheap as possible.

In order that the invention may be clearly understood, reference may be had to the following description and accompanying drawings, by way of example, in which,

Figure 1 represents a longitudinal section through the projectile,

Figure 2 shows the same projectile also in longitudinal section after passing through the added part of the barrel,

Figures 3 and 4 show other alternatives of the projectile, Figure 3 showing this before the deformation, and Figure 4 after the deformation, and

Figures 5 and 6 indicate a process in the production of the projectile.

In Figure 1, 1 is the piercing core of the projectile, which core is retracted in its rear part to a smaller diameter, and the retraction is carried out with a cone-shaped transition. The core consists preferably of tough steel and is hardened. The jacket of the projectile 2 consists of material adapted to be shaped, e. g., soft iron, brass, "alpakka" (nickel silver), copper or the like. It forms at the front part an ogive, which corresponds to the terminal calibre of the projectile, then merges in conical form into the cylindrical guiding portion having the diameter a_2 corresponding to the initial calibre and the bore of the barrel. The forcing band n is at the end of this cylindrical portion of the jacket and serves, on the one hand, for the sealing and, on the other hand, for guiding the projectile in the rifling of the barrel. The forcing band is consequently preferably shifted quite to the end of the projectile, so that the cylindrical portion of the jacket is not exposed to the external excess pressure of the gases and is not deformed by this pressure. The end of the jacket is flanged over and pressed firmly against the cone-shaped transition, into the retracted part of the core 1.

When the projectile passes through the barrel bored over the whole length to the initial calibre a_2 and provided with rifling grooves and already attains practically the maximum velocity, it penetrates into the addition on the barrel, in the conically shaped transition portion of which its jacket is compressed into the terminal shape of the calibre a_1, as shown in Figure 2.

It is important for the correct and exact flight of the projectile that its rear part is quite smooth and perpendicular to its longitudinal axis. This is attained by the margin at the rear part of the projectile which forms a reinforcement of the jacket part and even before the placing of the projectile in the barrel is made with a smaller diameter than the end calibre of the projectile, so that on the passage of the projectile through the added part it is not deformed but remains straight and perpendicular to the axis of the projectile.

The retracted part of the core is advantageously made so long that the rear part of the projectile is, after the deformation and stretching of the jacket, filled up by the core, as shown by Figure 2. In this way, there is attained a sufficient cross-sectional loading of the projectile and also an increase of the proportional weight of the core, and thus an increase of the effect on the armour.

In Figure 3 is shown another alternative of the armour piercing projectile before the deformation, and in Figure 4 the same projectile after the deformation. With this projectile, the core is not retracted to a smaller diameter but is terminated conically. This projectile is suitable in particular for larger calibres or smaller differences in its initial and terminal calibre, where the stretching or extension of the jacket is comparatively smaller, so that the rear part of the projectile is sufficiently filled up without retraction of the core. With the projectile according to Figure 3, the forcing band is subdivided into two parts n_1 and n_2, of which one is arranged

quite at the end of the jacket, so that it prevents the penetration of the gases of great pressure on to the cylindrical guiding part of the jacket. By the arrangement of two forcing bands, there is attained on the one hand a better sealing of the projectile and on the other hand, a longer bearing of the projectile in the neck of the cartridge.

The process of making the projectile is shown in Figures 5 and 6. The projectile jacket is pressed into the shape shown in Figure 5. The forcing band can with advantage be pressed out from the jacket, as shown in Figure 5. The end of the jacket is then bent over and an edge is formed on it, the inner diameter of which exactly corresponds to the diameter of the core, as shown in Figure 6. The edge forms on the one hand a reinforcement of the bend of the jacket, and on the other hand the jacket core is thereby exactly centered in the making. After the insertion of the core in the jacket, the edge is bent over and firmly pressed against the conical part of the core until the core and jacket are firmly connected together and the hollow space in the projectile is sufficiently tight. With larger projectiles, the edge on the jacket may also be turned out (according to Figure 6).

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FRANTIŠEK KAREL JANEČEK.

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MAY 4, 1943.
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F. JANECEK ET AL
ARMOUR PIERCING PROJECTILES
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FIG. 1.

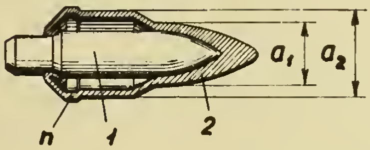


FIG. 2.

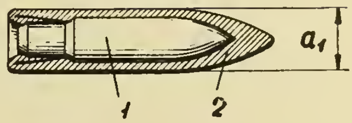


FIG. 3.

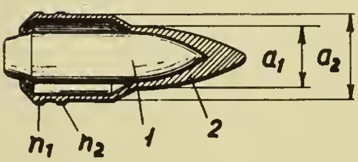


FIG. 4.

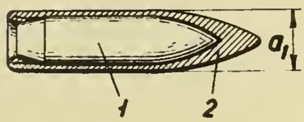


FIG. 5.

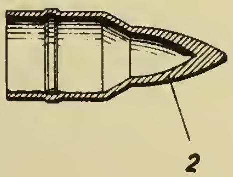
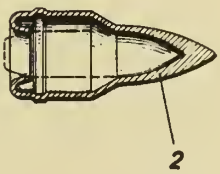


FIG. 6.



Inventors
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By B. Singer, atty.

Published May 4, 1943 **Serial No. 251,638**

ALIEN PROPERTY CUSTODIAN

MACHINES FOR TREATING TEXTILE MATERIAL

Marcel Cassé, Essonnes, France; vested in the Alien Property Custodian

Application filed January 18, 1939

The present invention relates to an improved machine particularly adapted to be used for the dyeing, washing or finishing of textile materials and comprising a vat in which the bath is circulated in one direction or alternately in opposite directions by a propeller or like device which withdraws liquid from a vertical axial conduit or discharges into the same.

The invention has for its general object to provide a machine of this type of simple construction, having a great efficiency and which may be readily transformed to suit the different works to be performed. The invention therefore consists of a machine of the above-mentioned type in which the propeller or like device ensuring the circulation of the liquid is located at the lower part of the vat in the interior of a fixed ring to which it is possible to secure, according to the operation to be performed, together or separately, one or more independent removable parts, such as a perforated false bottom adapted to divide the said vat into two superposed compartments, and one of a plurality of longitudinal axial conduits of different lengths, diameters and arrangements according to the particular work for which each of these is adapted.

The invention further consists of a set of axial conduits of large diameter, which may be mounted on the ring of the machine, and of a set of deflectors, adapted to be mounted on the conduit employed.

In the accompanying drawings, which are given solely by way of example:

Fig. 1 is a vertical longitudinal section of a machine in conformity with the invention.

Figs. 2, 3 and 4 are similar partial sections, showing modified forms of deflectors and conduits.

In the embodiment shown in Fig. 1, the machine comprises a fixed part, which is adapted to receive various removable parts.

The fixed part comprises a hollow base or frame **1** to which is secured by bolts **2** or the like, a hub **3** connected by radial arms **4** to a ring **5**. Upon the said ring rests and is secured a solid bottom **6**, of frusto-conical or like form, the central part of which is clamped between the member **3** and a flange **7** of the external body **8** of a stuffing-box.

Through said stuffing box extends the upper end of a vertical shaft **9**. To this end is keyed, at a point above the bottom wall **6**, a propeller **10** or like device adapted to set up, according to its direction of rotation, a rising or descending axial current of the liquid.

The propeller **10**, or the like, is surrounded by a ring **11** which is secured by a number of arms **12** to the body **8** of the stuffing-box. The ring **11** is provided with bolts or screw-studs **13**, or like means for attaching the removable accessories which will be further described.

The shaft **9** which extends downwardly from said stuffing-box is supported for example by ball-bearings **14** and **15** and may be driven in rotation in either direction by a motor **16** or other prime-mover, for example through a transmission comprising pulleys **17** and **18** and a belt **19**.

The fixed device above described is completed by removable accessories which in the case of Fig. 1 are as follows:

On the ring **5** there are secured by bolts **20** or the like, together with the bottom **6** and with interposed packing material, a perforated wall **21** forming a false bottom and a cylindrical wall **23** forming a vat.

On the ring **11** surrounding the propeller **10** there are secured by bolts **13** the edge portion of the false-bottom **21** bounding a central opening provided in said false bottom and a tube **24** with solid walls forming an axial conduit of large side (its diameter may exceed ¼ even ⅓ of the diameter of the vat **23**), and one or more arms **25**, carrying a nut **26** in which there is screwed and locked by a nut **27**, or otherwise secured, a vertical axial rod **28** terminating in a threaded portion **29**.

The tube **24** is preferably connected at its upper end to a perforated rosehead **30** which is slidable on the rod **28**.

On the tube **24**, there is slidably mounted a perforated basin **32** to which are secured an outer ring **33** and a central ring **34**. The said rings have secured thereto suitable cross-braces **35** and **36** which are connected together by an axial tube **37**. At the lower part of said tube, the arms **36** carry a solid disc **38** forming a deflector.

The tube **37** carries at its upper end an abutment member **40** through which extends loosely the rod **28** and on which bears a wing-nut **41** or the like, which is screwed upon the threaded portion **29** of the rod **28**.

The operation is as follows. The goods to be treated, such as hairs, fabrics, stockings etc. are placed in the vat **23** on the perforated bottom **21**. The disc **32** and the deflector **38** are then put in place, and their height is adjusted by the nut **41**. The vat **23** contains the treating bath, in the compartment **22**.

The propeller **10** is then set in rotation in the direction in which it will withdraw liquid from

the compartment 22 below the false-bottom 21 and will discharge it into the conduit 24. Owing to the large cross-section of the said conduit, the output of liquid may be considerable. By the action of the deflector 38, the stream of liquid is deflected downwardly, and the liquid is supplied in great quantity upon the whole surface of the disc 32. The liquid then returns to the compartment 22 by circulating downwardly through the perforated wall 21, against which it applies the goods under treatment.

The propeller 10 thus produces a constant and powerful current which applies the goods to be dyed against the false bottom 21. The goods will thus have no movement and in the case of stockings or half-hose, for instance, they will not become entangled, and they may therefore be simply put in bulk into the machine.

Pieces of fabric can also be dyed in the machine and for this purpose they are placed in spiral fashion in the vat 23 in such way as to form a layer of substantially uniform thickness.

If the disc 32 does not press upon the goods, the propeller can be stopped at certain times. The goods to be dyed will then leave the perforated false bottom 21 and will float. When the propeller is again operated, the goods will be again drawn by suction upon the bottom 21, but they will have changed their places and their folds, and will be uniformly dyed.

For other goods, it may be useful to effect a periodic reversal of the direction of rotation of the propeller 10. This reversal may be automatic or may be controlled manually by the dyer. It is in this case that the disc 32 is useful. The goods to be dyed are lifted by the current of the bath and come against this perforated wall which prevents the goods from following the bath and from being drawn into the conduit 24.

For the dyeing of raw textile fibres or of certain goods in bulk, the goods are placed upon the perforated false bottom 21, and the perforated disc 32 is pressed upon them in such way as to hold them fast when the current of the bath is reversed, in order to prevent them from felting together, for example.

In the modification shown in Fig. 2, the deflector consists of an axial inverted cone 42 having solid walls, which is secured at 43 to the large base of an inverted perforated tapered member 44, which is preferably extended by a perforated cylindrical part 45 which is slidable in the conduit 24, for the vertical adjustment.

The inclination of the generatrices of the said tapered member 44 is such that the streams of water or other liquid issuing from the perforations of this tapered member will be directed towards the perforated bottom 21 so as to provide for a distribution of the output as uniform as possible upon this bottom. The internal cone with solid walls 42 subdivides the vertical ascending stream, and provides for a uniform circulation of the bath within the perforated tapered member 44.

One of the advantages of the member 44 over a simple cylindrical perforated tube (or provided with a grating) extending the tube 24, is that it permits of reversing the current of the bath, without the goods in process of dyeing being withdrawn by the suction of the propeller 10, while at the same time maintaining an appreciable output, as the perforated surface of the said tapered member is greater than the surface of a cylinder of the same height, and for this reason is therefore less liable of being stopped by goods applied against it.

In the modification shown in Fig. 3, the slidable tube 45 has solid walls, and the perforated tapered member 44 comprises, in its interior, concentric circular deflectors 46, 47, 48 having curved surfaces of revolution, which are adapted to change the direction of the upward current of the bath, and to direct the bath in such a way that it will descend and will be distributed upon said false bottom 21 according to any desired law, for example, in a uniform manner.

In the modification shown in Fig. 4, the false bottom 21 represented in the preceding constructions is replaced by a simple disc 29, to which is secured the cylindrical perforated tube 50.

This tube 50 is closed at the top by a solid wall 51 and a nut 52. The disc 49 forms a flange. Another flange 53, which is removable, is provided at the upper part and is mounted on a sleeve 54 which fits upon the tube 50 and comprises an end wall 55 on which bears the nut 41 screwed on the threaded end 29 of the rod 28, thus providing for the vertical adjustment of the position of the said flange 53.

This device can be used to great advantage for the dyeing of pieces of fabric. The fabric may be wound around the perforated cylinder 50 (the height of said cylinder being in this case equal to the width of the fabric). In the case of a tubular piece of fabric, the said fabric is threaded at 60 over the perforated cylinder, after having removed the flange 53.

A second perforated cylinder having a larger diameter than the preceding may be placed around this latter in order to limit the movement of the piece of fabric placed around the conduit 50 when the current of the bath is reversed.

If desired a device for heating the bath may be provided. The device may advantageously consist of a perforated steam header 56, concentric with the propeller 10, secured to the ring 11 and supplied with steam through a conduit 57, the steam jets being upwardly directed. This steam will heat the bath, and the jets, by their action, will aid in the circulation of the bath.

Obviously, an indirect heating device may be employed, which may consist of a steam carrying coil arranged in the compartment 22.

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MACHINES FOR TREATING TEXTILE MATERIAL

Filed Jan. 18, 1939

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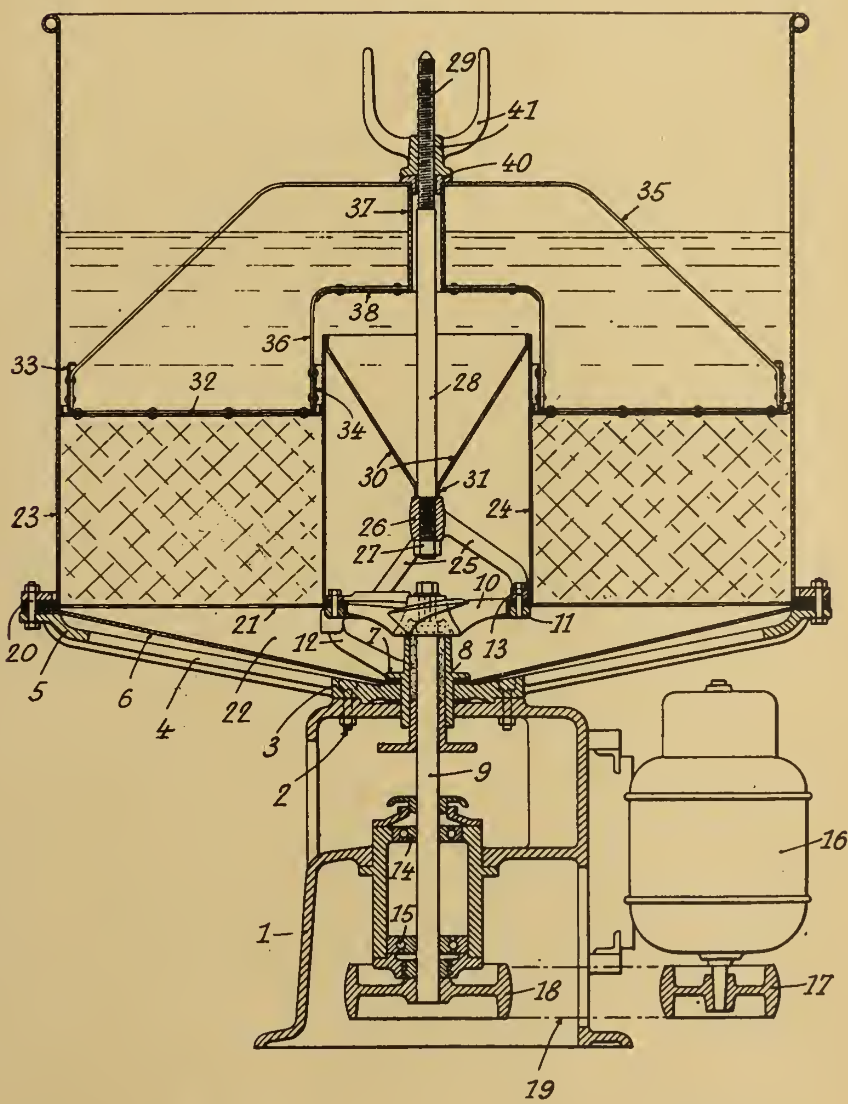
3 Sheets-Sheet 1

Fig. 1



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3 Sheets-Sheet 2

Fig. 2

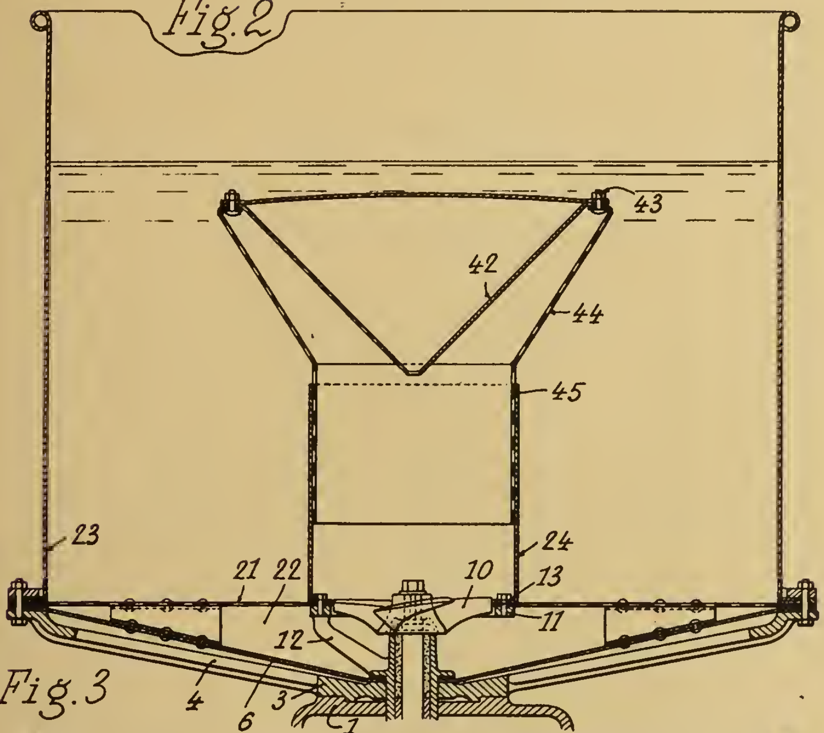
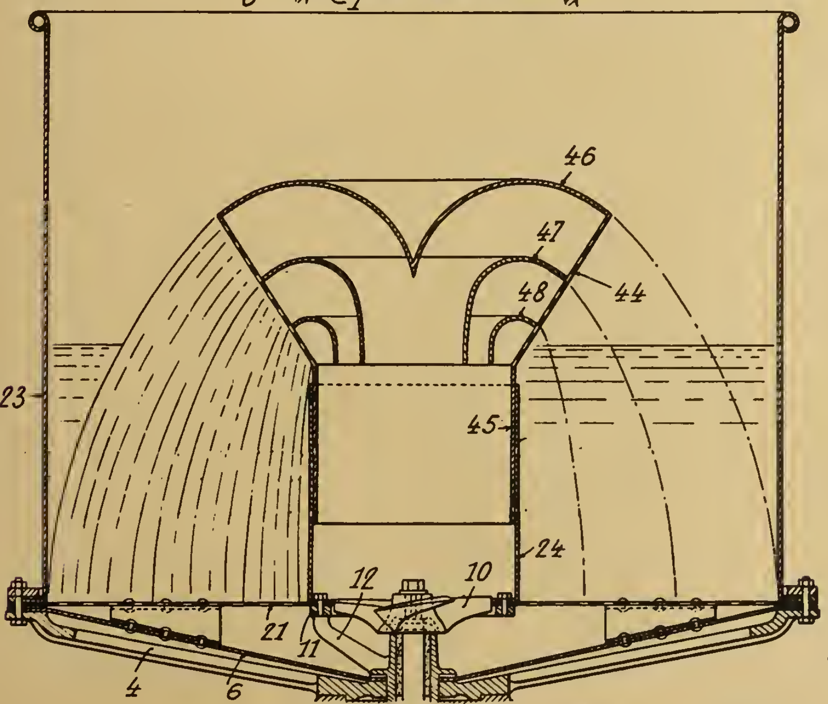


Fig. 3



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MACHINES FOR TREATING TEXTILE MATERIAL

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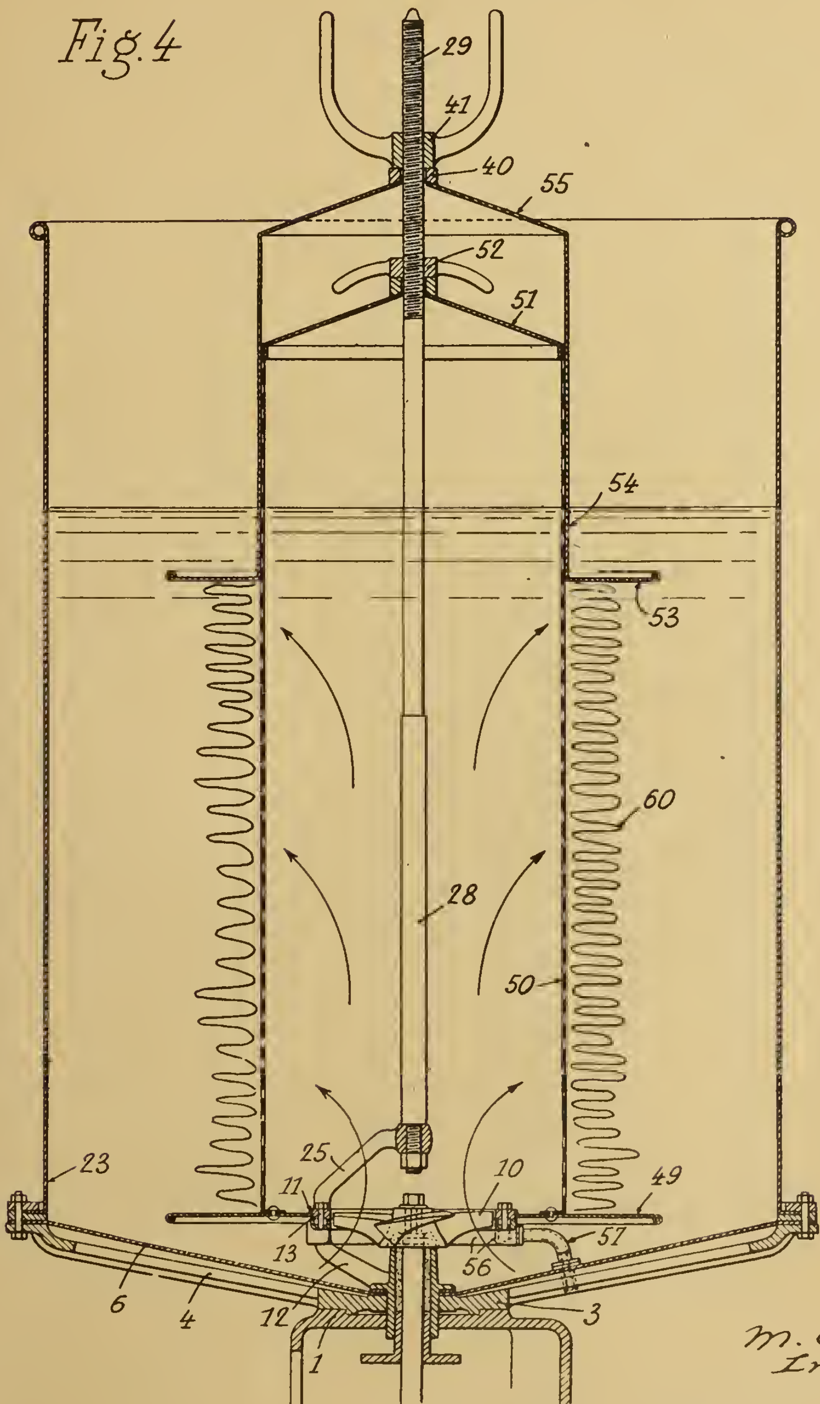
3 Sheets-Sheet 3

Fig. 4



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Published May 4, 1943 Serial No. 253,479½

ALIEN PROPERTY CUSTODIAN

METHOD FOR REDUCING DEFORMATIONS OF FERROCONCRETE BEARING CONSTRUCTIONS

Ewald Hoyer, Berlin-Halensee, Germany; vested in the Alien Property Custodian

Application filed January 30, 1939

The invention relates to the production of ferroconcrete bearing constructions of larger dimensions, such as halls and bridges etc. with wide spans. In constructions with wide spans considerable deformations, especially deflections, are caused by external loads (dead weight, useful load, etc.). These deformations of ferroconcrete constructions may be counteracted by tensioned reinforcements. However, in the case of large ferroconcrete constructions with wide spans, such reinforcements, setting up internal forces, are not sufficient to prevent detrimental deformations.

It is known, especially in the case of certain ferroconcrete constructions, such as arched bridges with suspended road-ways, to use tensioned straps in order to counteract deformation or deflection. However, the use of such straps tensioned within the arched bridge is limited to this type of bridge or to similar constructions. In addition, special care has to be taken in transmitting the tension of the straps to the ferroconcrete construction, these straps being tensioned gradually while incorporating the reinforcements.

In contrast with this procedure, the method according to the invention consists in using tensioned straps acting as external forces upon the ferroconcrete bearing construction. In accordance with the invention, the straps are, for this purpose, anchored with one end in fixed supports and are then tensioned independently of the bearing construction, and while or after the latter is completed, the tension is removed from the other ends of the straps. In this way external forces are introduced into the bearing construction by the straps anchored at one end, initially counteracting deformations caused by external loads. In applying this new method, the straps are made of tensioned concrete, i. e. the highly tensioned reinforcing members, for example highly tensioned steel wires, are incorporated in the concrete in this tensioned state, and not until the concrete has hardened, the tension is removed from the one end of the straps. Suitably constructed straps may at the same time serve to reinforce the bearing construction, the deformation of which is thus reduced by both external and internal forces transmitted by these straps. All deformations of the bearing construction, including those of the traps, are thus reduced to a minimum. The new method permits not only of improving and strengthening the known types of statically determinable and undeterminable ferroconcrete constructions, but also of developing entirely new types of constructions.

The accompanying drawing illustrates, by way of examples, ferroconcrete bearing constructions produced according to the new method.

Fig. 1 is a diagrammatic illustration of a cantilever girder.

Fig. 2 is a different type of cantilever girder.

Fig. 3 is a tensioned ferroconcrete girder with two supports.

Fig. 4 is a three hinged arch.

Fig. 5 is a socle-girder.

Fig. 6 is a bridge construction.

Fig. 7 is a two hinged frame.

Fig. 8 is a continuous girder.

The cantilever girder 1 made of ferroconcrete, as illustrated in Fig. 1, rests on the two supports A and B, the ends of the girder being attached to the straps 2 of tensioned concrete, acting as external forces. The reinforcing members 3 of these straps are highly tensioned between the two points 4 and 5 and are then covered with concrete. Not until the girder 1 is completed, the tension is removed at point 5 of the strap, for example by cutting the reinforcing member along the line *a*—*a*. The straps 2 then act as external forces on the girder 1 by causing a bending moment opposite to the load of the girder, thus preventing the latter from deflecting.

In fixing the girder, it is also possible to reduce the tension at point 5 before covering the straps 3 with concrete, thus transmitting a certain amount of initial tension to the girder 1 by the straps 3. Then, the straps 3 are covered with concrete, and after the latter has hardened, the tension at point 5 is removed entirely.

An advantageous practical construction of a girder according to Fig. 1 is illustrated in Fig. 2. The ferroconcerete girder 6 rests on the supports 7 at A and B in such a way that a space 9 remains between the ends 8 of the girder and the supports 7. The straps 10 consisting of steel wires or the like are anchored in the supports 7 and, being temporarily fixed to point 11, are subjected to a high tension. After completion of the girder 6, the tension at point 11 is removed by cutting the straps along the line *a*—*a*, whereby the tension of the straps 10 is automatically transmitted to the ends 8 of the girder 6. Naturally, the straps 10 must be rigidly connected to the ends 8 of the girder before removing the tension, for example by letting the straps 10 act on the girder by means of anchor plates. This special anchoring is, however, not necessary if very thin steel wires are used, the friction of such thin wires in the concrete and the face pressure being sufficient to transmit the tension.

The space 9 between the ends 8 of the girder and the supports 7 is advantageously filled with concrete. By filling concrete into the space 9 before removing the tension at point 11, the concrete between the ends 8 of the girder and the supports is subjected to a compressive stress. In this manner, a ferroconcrete girder fixed at both ends is obtained.

Fig. 3 illustrates a ferroconcrete girder 12 resting on two supports A and B with the straps 13 and 14 acting as adidtional external forces and advantageously consisting of continuous reinforcing members, highly tensioned and anchored in the supports 15. After completion of the girder 12, the tension of the straps is removed in the middle of the girder by cutting the continuous reinforcing members at the points *a*. Thus, individual straps 13, 14 are formed, causing a pressure or a bending moment in the girder 12, counteracting the opposite bending moment caused by the load. The spaces 16 between the girder 12 and the supports 15 are advantageously filled with concrete so that the girder illustrated in Fig. 3 acts like a fixed girder.

Fig. 4 shows a three hinged arch with straps 17 and 18 and a lower tension member 19. The production of this three hinged arch is similar to that shown in Fig. 3 and consists in first anchoring the continuous straps 17, 18, advantageously made of one piece, in the supports 20 and then subjecting them to a high tension. In the same way, the lower tension member 19 is tensioned between the supports 20. After completion of the pieces 21 of the arch, this tension member is, for example, released by cutting along the lines *a*—*a*, thus transmitting the entire initial tension of this tension member to the hinged arch. Then the straps 17, 18 are cut at the points *b*—*b*, thereby transmitting the initial tension of these straps to the two pieces 21 of the arch. Thus, two external tensile forces are set up in the direction towards the supports 20, acting upon the arches 21 at the top and causing a bending moment which counteracts the load.

Fig. 5 shows a socle-girder 22 with straps 23 anchored in the support 24 and temporarily fixed to a point 25 outside the construction and highly tensioned. After completion of the socle-girder 22 the tension at point 25 is removed by cutting the straps, whereby the tension of the straps 23 is transmitted to the girder 22. These straps 23 are advantageously arranged inside the girder 22 so as to serve at the same time as reinforcement members of this girder and to cause a compressive stress. The space 26, provided between the socle-girder 22 and the support 24, may be filled with concrete, which should be done before removing the tension from point 25, thus producing a kind of tensioned girder at this place too.

Fig. 6 shows a new ferroconcrete bridge construction, being a combination of a suspension-bridge and a fixed girder. The fixed ferroconcrete girder 27 rests on supports A and B of the two pillars 28 and is also held by supports from the top. The straps 29 connected to this girder are anchored with one of their ends in supports not shown in the drawing and are conducted over the pillars 28. The other ends of the straps are fixed below the girder at points 30 and are highly tensioned. This tension in the straps may also be produced by attaching loads to the ends of the straps or at the points 30.

These straps may be arranged so as to carry all scaffoldings and other articles required for building the bridge. In this case, the initial tension of the straps should be higher than the load for which the girder 27 is intended. These highly tensioned straps are covered with concrete, and after completion of the girder 27 the tension of the straps 29 is removed at the points *a*. The extended straps have the tendency to return to their former unloaded position. Being rigidly connected to the girder 27, they release the latter by producing moments in the girder in a direction opposite to the load. In this way it is possible to produce ferroconcrete bridge constructions with wide spans without causing fissures and subject to very slight deformations as compared with constructions of known type.

The straps consisting of tensioned concrete may also be used for other ferroconcrete constructions, for example for a two hinged frame as illustrated in Fig. 7. This is provided with straps 31 tensioned between two supports 32 and passing through concrete within the frame 33 to which they are fixed at the points 34. After completion of the frame, the tension is removed from the supports 32 by cutting the straps at the points *a*—*a*, so as to transmit the tension of the straps 31 to the frame 33, producing a horizontal force which counteracts the horizontal movement caused by loading the frame.

The method described with the aid of Fig. 7 may also be applied to arched bridges. The horizontal movement at the ends of the arches caused while incorporating the reinforcing members is counteracted by the highly tensioned straps, reducing the tension at the ends of the straps, i. e. between supports 32 and fixing points 34 in Fig. 7. By applying this method, the tension of the straps is automatically transmitted to the construction.

Fig. 8 shows a continuous ferroconcrete girder 35 resting on supports A, B, C. The bending moments at the supporting points of the continuous girder are balanced by straps 36 which are first highly tensioned between the points 37. After the straps have been covered with concrete, for example as shown in Fig. 8, the tension is removed from the points 37 by cutting the straps at the places *a*—*a*.

The reinforcing members of the straps may consist, for example, of steel rods or steel wires. As stated above, the use of thin steel wires of, for example, 0.5 to 4 mm diameter and having a strength of approximately 12000 to 30000 kgs. per sq. cm., has the advantage that no special anchoring is required. Moreover, the use of such strong wires permits the application of a very high initial tension. Even in the case of comparatively short straps made of such steel wires, the extension caused by the initial tension is comparatively great, so that it is also possible to transmit the calculated tensile forces of short strips with certainty.

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MAY 4, 1943.

BY A. P. C.

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METHOD FOR REDUCING DEFORMATIONS OF FERROCONCRETE BEARING CONSTRUCTIONS

Filed Jan. 30, 1939

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2 Sheets-Sheet 1

FIG. 1.

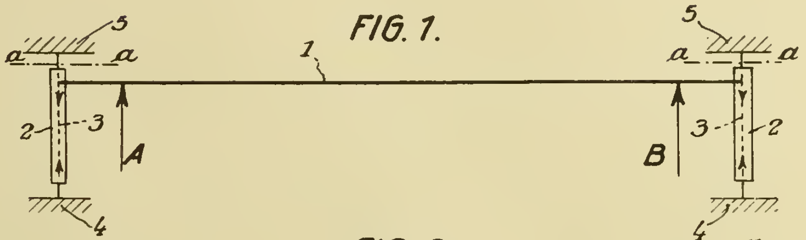


FIG. 2.

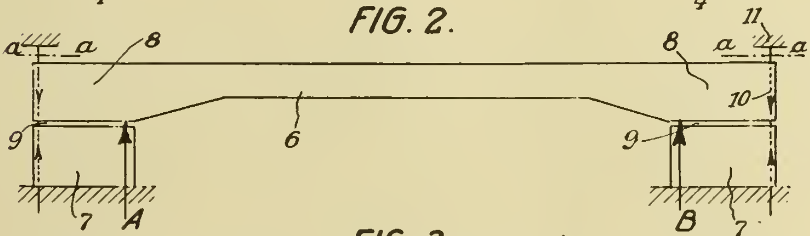


FIG. 3.

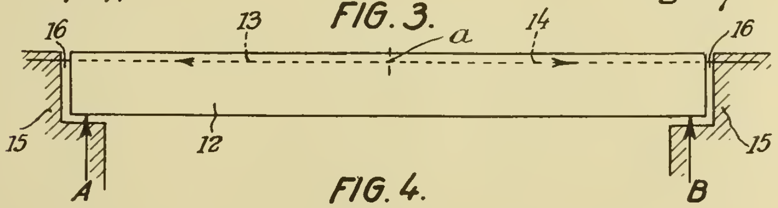


FIG. 4.

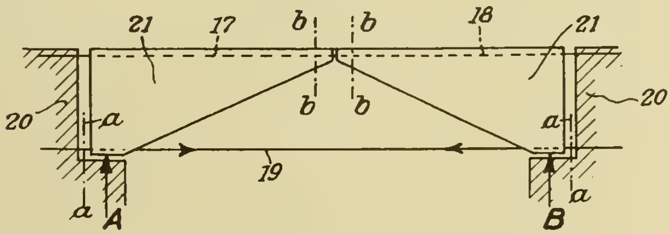
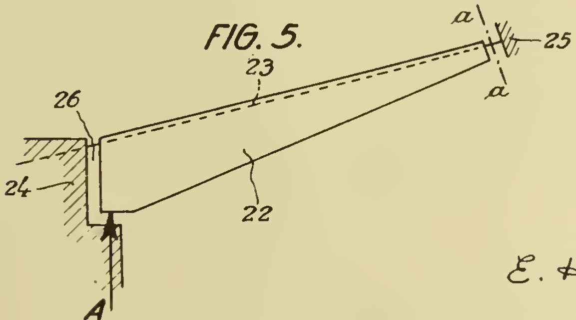


FIG. 5.



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2 Sheets-Sheet 2

FIG. 6.

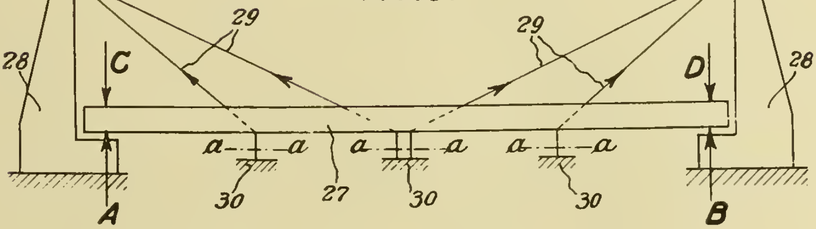


FIG. 7.

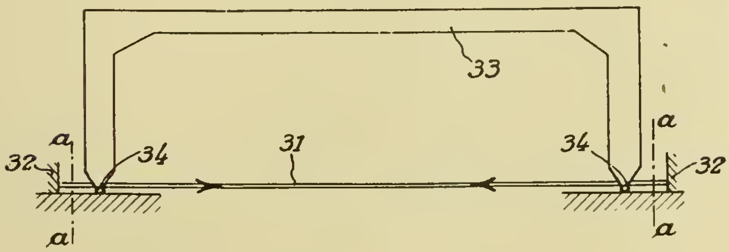
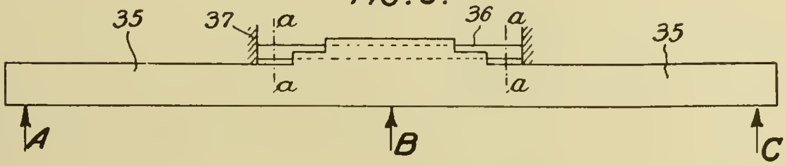


FIG. 8.



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ALIEN PROPERTY CUSTODIAN

GLASS PANELS

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Application filed January 31, 1939

The present invention relates to plates and panels of glass especially, although not exclusively, intended to be used for making wall linings.

A first object of the present invention is to provide a colored glass panel or plate which is strong from all viewpoints and easy to manufacture rapidly and at low price.

Another object of the invention is to provide a method of assembling a glass panel of this kind to a support through which a plurality of panels can be assembled and held in position.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a sectional view of a glass panel according to the invention applied on a concrete support;

Fig. 2 is a similar view of a glass panel of the same type applied on a plywood support.

The glass panel according to the present invention is obtained by applying on the back surface of a glass plate of any desired kind, shape and size a coating of a varnish, coloured in any suitable manner, obtained as follows:

In a suitable solvent, consisting for instance of a mixture of toluol and benzol, I dissolve a polychlordiphenyl containing a particularly high amount of chlorine (from 60 to 70%) and of high melting point (from 65 to 70° C.), that is to say a chlordiphenyl of a resinous rather than oily character.

In some cases, it may be advantageous to increase the viscosity of the varnish without altering its specific physico-chemical function, for instance by adding other chlorine derivatives of the aromatic hydrocarbons, such as chlor-caoutchouc.

When it is desired to provide the glass panels with a concrete support, I proceed as follows:

Taking a glass panel as above described, I apply on the back face thereof a slight layer of the varnish above described (which in this case needs not be colored), and, immediately after, I sprinkle this layer with a small amount of sand or any other material capable of being bound with mortar or concrete.

After drying of this thin coat of varnish, the sand sprinkled thereon is fixed in a lasting manner and therefore constitutes a very good anchoring surface for the mortar or cement which is applied in any known manner so as to form a layer of the desired thickness and shape.

The sand sprinkled on the back face of the glass panels can be fixed thereon in any other way. For instance, instead of making use of the varnish above mentioned, I might use an alcohol solution of phenol-formaldehyde resin, an aqueous emulsion of rubber, bitumen, paraffin, etc. Or I might directly cover the dry layer of varnish which forms the back face of the glass panel with hot sand (previously heated to at least the temperature at which the polychlordiphenyl that is employed softens), so that said sand, after cooling, is fixed superficially in a very secure manner.

A structure including a glass panel according to the invention fixed on a concrete support is diagrammatically shown by Fig. 1. The glass plate **1** (of a thickness ranging from say 2 mms. to any desired value) is provided, on its back face, with a layer **2** of the varnish above described (of a thickness averaging, for instance, 0.05 mm.), and said varnish layer adheres, as above explained, to the concrete support.

When it is desired to provide for the glass panels another support, for instance of plywood, eternit, cardboard, cloth, etc., it suffices to secure these materials to the varnish layer of the glass plate through any suitable glue or cement, provided that this glue or cement does not attack the chlordiphenyl varnish. For instance I might make use of a polyvinil alcohol glue, a Bakelite alcohol glue, a lac alcohol glue, and so on.

A structure including a glass panel according to the invention fixed on a ply-wood support is diagrammatically shown by Fig. 2. It includes a glass plate **1**, with its varnish layer **2**, and the plywood layer **4** fixed to said face of the glass panel.

It should be noted that, according to the present invention, the glass plate **1** on which the varnish layer **2** is applied may be of transparent glass, of glass colored throughout its mass, of fire enamelled glass.

It is further pointed out that the varnish of layer **2**, which is preferably colored so as to obtain a colored glass panel, must comply with the following conditions, which are necessary for obtaining a perfectly satisfactory product:

a. Good and permanent adhesion to glass;

b. Impermeability, insolubility and absence of swelling in the presence of water;

c. Relative inertia to any chemical function;

d. Good resistance to photo-chemical actions;

e. Very good coefficient of absorption of thermic expansions and of static and dynamic stresses;

f. Chemical stability;

g. Sufficient achromatism not to influence the most delicate shades;

h. Neutral chemical function so as to permit the use of mineral colors and of organic lackers of all kinds;

i. High softening and melting points;

j. Facility of application.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of the present invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the appended claims.

UGO SOMIGLIANA.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

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GLASS PANELS

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Fig.1

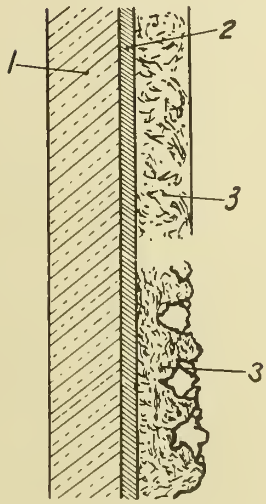
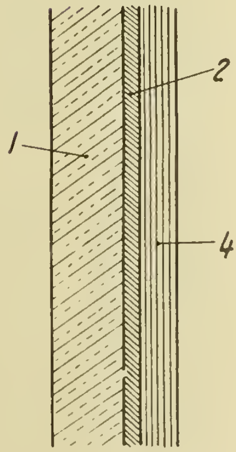


Fig.2



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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF HARD PLATES FROM VEGETABLE FIBRE PULP

Hermann Basler, Leutkirch/Allgau, Germany; vested in the Alien Property Custodian

Application filed February 4, 1939

This invention relates to a process for making hard plates from vegetable fibre pulp and has as its object, with better and more careful dehydration, felting and utilisation of the binding agents which may be employed, the production of hard plates with extraordinarily compact texture and fault-free and bubble-free surfaces in a manner suitable for mass production.

The object aimed at is attained according to the invention by first of all lightly pressing the fibrous pulp in the cold state and thereby preliminarily dehydrating, then the pressure is reduced to zero and after that, with unequal heating of the two surfaces of the preliminarily pressed material by the press plates over a fairly long space of time, a medium pressure is employed, may be with suction action, then the pressure is again lowered to zero and again high pressure is employed with heating but without suction action, whereupon the press pressure is reduced without change in temperature, which is then maintained over a fairly long period of time and finally is increased again gradually approximately up to the maximum pressure with continuous increase in temperature.

A further characteristic of the invention, which is new per se, consists in this that during the pressing one side of the material being pressed is disposed on a sieve which is heated to higher temperature than the side of the press material turned away from the sieve, which side abuts against a press plate.

The accompanying drawing shows by way of example a diagram illustrating the course of the new process. In carrying out the new process in the first stage I the vegetable fibre pulp is introduced into a press at a temperature of 10–70° C. and in this press is subjected to a pressure up to about 3 kg/cm^2. for about two minutes. The plate preliminarily formed in this way is then, after temporary reduction of the press pressure to zero, subjected in a second process stage II to a pressure of about 20 kg/cm^2 for a time of about four minutes in a second press, with or without suction action as well. During this pressing the lower surface of the fibrous material plate lies on a sieve, whilst on its upper surface presses a press plate consisting for example of copper. Sieve and press plate, however, may also be reversed. In this second process stage raised temperature is employed, and the surface of the fibrous material plate turned towards the sieve is heated more highly than its surface turned away from the sieve. On the surface of the plate turned away from the sieve preferably a temperature of about 90° C. is employed as compared with a temperature of about 160–180° on the side of the fibrous material plate turned towards the sieve. In consequence of the unequal heating of the two surfaces of the fibrous material plate, the fibre particles in the proximity of the colder press plate dry more slowly than those in the proximity of the sieve. As a result the smooth surface of the preliminarily shaped plate, that is to say the surface turned away from the sieve, is maintained plastic. In this way a premature consolidation on this surface is prevented, which more particularly when using binding agents, can form a sort of film or crust which then prevents the further vaporisation from the interior of the plate. As a result also the marks, defects and bubbles which otherwise readily appear on this side of the fibrous material plate are avoided. Owing to the more rapid drying of the side of the fibrous material plate turned towards the sieve, this latter side of the plate becomes more solid as a whole and can be more readily handled in the subsequent stages of the process.

The treatment of the preliminarily shaped fibrous material plate described above ensures that the moisture content of the fibre cake is already reduced to a minimum, which relieves the working in the treatment of the fibrous material plate in the last process stage inasmuch as too strong a cooling down, to be attributed to too large a moisture content, can no longer occur.

The fibrous material plate treated in the two first process stages I and II is after again temporarily reducing the press pressure to zero passed in a third stage either in the same or in another press at an initial temperature of 140° for one or two minutes under a pressure of about 50 kg/cm^2 and thereupon is pressed with simultaneous raising of the temperature to about 160° and lowering of the press pressure to about 20 kg/cm^2. Then in a fourth process stage IV the pressure is reduced to about 15 kg/cm^2, and, according to the thickness of the fibrous material plate being prepared, the temperature is raised to 160–200° in a time of 15–20 minutes, whereupon, depending on this temperature raising, in a fifth process stage V pressure is raised from about 15 kg/cm^2 to about 60 kg/cm^2 during a time of about 20 minutes. The fibrous material plate is then ready. It is perfectly flat, very solid and strong, but at the same time elastic, and even after long storage or long use shows no shape change.

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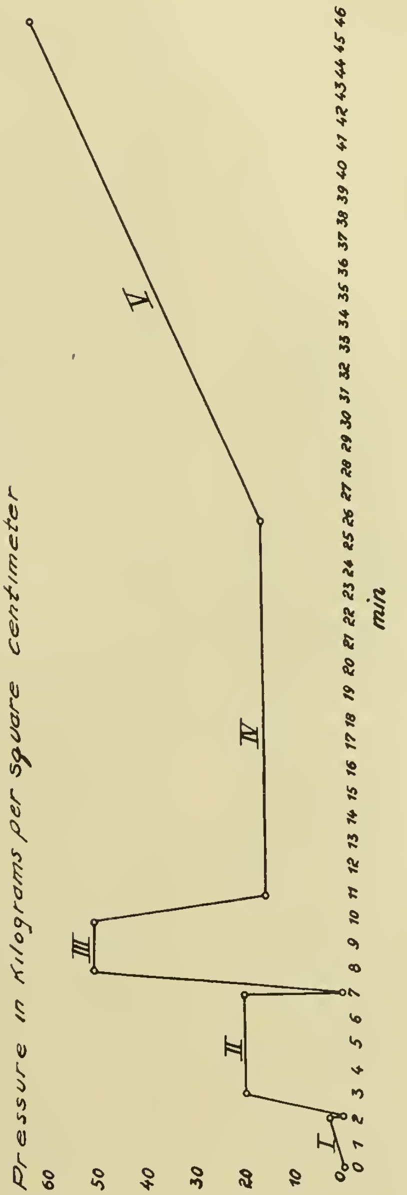

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AUXILIARY AEROPHOTOGRAMMETRIC SURVEYING APPARATUS, INCLUDING THE OBTAINMENT OF PHOTOGRAPHS OF THE SUN AND ENABLING THE REALIZATION OF A NOVEL PROCESS OF AEROTRIANGULATION

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In the applications of aerophotogrammetry to topographical surveying on a vast and medium scale, the setting of the restitution or plotting apparatus appertaining to each pair of photograms is generally based on a certain number of ground points of known position, whereof the images appear on the said photograms.

In the applications of aerophotogrammetry to the small scale topographical survey of vast regions, the determination on the ground of a sufficient number of points of reference, according to the process alluded to above, would involve too much hard work which would not render the use of aerophotogrammetry advantageous.

With a view to reducing the number of ground points of reference, various aerotriangulation processes have been excogitated which generally allow of plotting from a series of photograms, taken during the course of the airplane, based on a few ground points only appearing in the first and in the last pair of photograms.

The practical carrying out of these processes calls for very delicate treatment and gives rise to considerable progressive errors when all the position elements of each new photogram of the series have to be deduced from the preceding photogram, as is the case, for instance, when use is made of the well-known method based on the elimination of the vertical parallaxes of the optical model.

A special device—already known—(Italian Patent No. 173,863 issued to the present applicant) supplies a position element appertaining to each photogram of the series, independently of the preceding photograms, by means of the chronometrically controlled photograph of the sun. Such device consists essentially in an auxiliary photographic camera, superimposed upon the main camera and connected to same, and destined to photograph the sun and the dial of a chronometer at each point of time when the main camera takes a photograph of the ground.

Assuming the position of two ground points to be known, the images of which appear in a photogram, the ascertainment a posteriori of the spatial position assumed by the photographic survey apparatus for that photogram is based on the following geometrical relations:

1° The approximate knowledge of the geographical co-ordinates of one of the two known ground points and of the time of day as photographed permits the calculation of the direction assumed by the sun rays at the moment of exposure relatively to the vertical and to the meridian passing through the said ground point.

2° The photographic apparatus is adapted to the direction of the said sun rays along the line of conjunction connecting the centre of the sun image with the centre of the objective by which same has been produced (auxiliary camera).

3° The photographic apparatus would be free to turn about the said line of direction, were it not impeded by the lines of vision preceding from the two known ground points which are defined, relatively to the photographic apparatus, (main camera) by the lines connecting the corresponding photographic images with the centre of the lens by which they have been produced.

4° The angular position of the photographic apparatus having once been defined in respect of points 2 and 3, the spatial position of same (orthogonal co-ordinates X Y Z of the centre of vision relatively to one of the known ground points) is defined by the known distance between the two ground points and by the angle formed between the lines of vision issuing from the said points, the value of which is furnished by the main photographic camera. In order to facilitate the determination of the angular values which connect the direction to the sun with the directions to the two ground points, the method already known (in subsequent improvements) provides a special photogoniometer which operates upon the said photographic apparatus (auxiliary and main cameras) into which there are once more introduced—centred relatively to the marks and suitably illuminated—the photograms containing the sun and the ground images, respectively. With the angular values derived from the photogoniometer and with the altazimuthal solar co-ordinates (deduced in the manner already mentioned) the determination of the angular and spatial position (elements of outer orientation) of the photogram may be effected by means of calculation.

By operating on a series of photographs, overlapping each other to the extent of 60% and selecting the two known points in the zone common to the first two photograms of the series, it is possible by the aforesaid method, to determine the elements of outer orientation for these two photograms.

By introducing the said photograms into a standard restitution or plotting apparatus, with the elements of orientation already determined, it is possible to obtain thereby the position of two new ground points selected in the zone common to the third photogram (20%). With these new points there may be determined the spatial position of the third photogram so that the process

may be continued indefinitely for all the photograms of the series.

With the aforesaid known method the use of a normal plotting apparatus is necessarily limited to the determination (restitution) of the two necessary ground points at the point of survey $n+2$ when the photograms n and $n+1$ shall have been placed in the restitution apparatus with the outer orientation values already determined by calculation. Said calculation comprises the solution of various spherical and plane triangles. All this, together with the necessary of having a special photographic apparatus for the ground survey at one's disposal (main camera) that is adapted to allow of the re-centring and of the illumination of the photogram for the purpose of operating thereon with the photogoniometer, render the method exceedingly laborious and therefore but little adapted to be applied to aerial surveying on a small scale.

The apparatus for which a patent is being sought, while utilizing the principles of the aforesaid methods as far as the photographs of the sun and of the chronometer are concerned, introduces two new elements represented by the recording of the photogram orientation (lateral swing) by means of a magnetic compass, to which there is added a gyroscopic compass, and by the recording of the differences of flying height, by means of a statoscope. The recording of the photogram orientation by means of a compass and that of the flying height, or of the variations thereof, by means of altimeters or stato-scopes, while not constituting any novelty per se, do realize, when combined with the sun-chronometer complex a novel characteristic ensemble inasmuch as the special combination of same leads to decidedly new results.

In effect, the orientation element furnished by the magnetico-gyroscopic compass constitutes in the first approximation the control of the photogram rotation about the direction to the sun, which according to the known method had to be derived from the two ground points having been determined. This innovation permits a great simplification in the aerotriangulation development. In effect, while it was necessary, with the method already known, to operate with the photogoniometer upon the whole surveying complex (solar device and ground photography apparatus) into which all of the photograms had therefore to be introduced and to be re-centred, with the new method, the photogoniometer operates solely on the auxiliary device which records the images of the sun, of the chronometer and of the compasses. This enables the combination, in a very simple manner, of the said device with an ordinary photographic camera, in which, as is well known, no re-centring or photogram-illuminating systems are provided.

According to the new method, the outer orientation elements (longitudinal inclination (ψ) lateral tilt (τ) and lateral swing (ω) of the compass-sun-chronometer (and consequently of the main photogram) are determined, in the first approximation, without the concurrence of the two known ground points, by means of a very simple calculation (the solution of two spherical triangles, one of which is a rectangle.

The setting, in a normal plotting apparatus, of the first two photograms of the series, comprising the two known points (starting basis) is effected in the first approximation, with great promptitude, by utilizing the angular values ($\tau\psi\omega$) calculated therefor. The plotting apparatus then enables the effecting of the lateral swing rectification ($\Delta\omega$) of the said photograms on the starting basis; which rectification becomes necessary when the initially imposed lateral swing value proves effected by the errors of the compass. For the purpose of ensuring that each photogram shall, in this rectification, (virtually) rotate about the solar direction, there are made in each lateral swing variation $\Delta\omega$ (measured on the plotting apparatus) corresponding variations of longitudinal inclination $\Delta\psi$ and of lateral tilt $\Delta\tau$, according to determinate incremental ratios

$$\frac{d\psi}{d\omega} \text{ and } \frac{d\tau}{d\omega}$$

These incremental ratios may easily be calculated previously together with the first approximation values ($\tau\psi\omega$).

The correct angular setting of the first two photograms having once been ensured, the proper proportioning of the optical model, and therefore, of the first side of the aerial polygon, is effected in the ordinary way, by means of the same starting basis. For the purpose of proportioning the next side of the polygon, and then the contiguous optical model, there is determined in the plotting apparatus, the position in planimetry and in height, of a ground point (connecting point) situated in the zone that is common to the third photogram, in the vicinity of the nadir of the point of survey. After the first photogram has been removed from the plotting apparatus and the second has been caused to take its place (materially or through binocular inversion) the third photogram is set in the place of the second.

The lateral swing rectification ($\Delta\omega$) of this photogram is effected in the ordinary way on the second, the vertical parallaxes at the points of the model approximately contained in the vertical plane passing through the second and third points of survey (vertical epipolar plane).

To this rectification ($\Delta\omega$) there will correspond the rectifications of longitudinal inclination ($\Delta\psi$) and of lateral tilt ($\Delta\tau$) according to the already calculated incremental ratios. The proportioning of the model is effected through the variation of the second side of the polygon to such an extent that the height newly determined for the connecting point shall correspond to that determined with the previous model.

While the transverse component (y) of the aerial base becomes automatically imposed during the lateral swing rectification operation, the vertical component (z) has to be imposed through the elimination of the vertical parallaxes for the two points of the model situated towards the opposite margins of the photograms in a transverse direction relatively to the serial base.

The process may be continued for all the photograms of the series, through a succession of lateral swing rectifications, differential corrections and corrections of longitudinal inclinations and lateral tilt and the equalization of the heights of the connecting points.

According to the new process just described, the errors of the magnetic compass exert no influence on the final adjustment of the photograms as long as the incremental ratios are applied to lateral swing rectification of liimted extent.

The knowledge of a base at the beginning of the series and of a base at the end, permits the correction of the systematic errors of the

magnetic compass (deflection—declination) so that the values furnished by same for the intermediate photograms only prove effected by accidental errors (oscillations of the needle). As these oscillations are generally considerable, the apparatus also provides for the utilization of a gyroscopic compass. The latter may be selected, for instance, from among the types of simple construction (with an air-turbine motor) already in use as an instrument of navigation on modern airplanes.

These simple gyroscopic compasses are, as is well known, liable to quite a considerable degree of residual precession, so that even during their normal use on board, they have to be adjusted by the pilot in order that they may mark the value indicated by the magnetic compass. They are, on the other hand, more stable than the latter, being effected in a far less degree by the swaying of the plane. The carrying over or transfer of the gyroscopic compass value to that of the magnetic compass by means of the device forming the object of the present invention, instead of being effected materially during flight, as is the case normally, is effected algebraically a posteriori, by comparison between the values indicated by the two instruments and recorded photographically. This carrying over is effected both at the beginning and at the end of the series of photographs, for a certain number of intermediate photograms, suitably selected under the conditions of minimum oscillation of the magnetic needle and is based on the examination of the corresponding photographic diagram.

In short, for all the intermediate photograms of the series the values of the gyroscopic compass (suitably compensated, as previously stated) are utilized as values of lateral swing to be introduced into the respective calculations of the angular outer orientations elements. The remaining corrections of lateral swing ($\Delta\omega$) to be made in the plotting apparatus, prove very slight in this case.

When the remaining errors of lateral swing for the values furnished by the gyroscopic compass are but slight, they may be preferred, for long distance travel, to the method described above, which might be termed one of "transferred orientation" the "independent orientation" method, based on the sole rectification relating to the lateral swing of each pair of photograms.

The recording of the variations of absolute altitude of the airplane at the various points of survey by means of a recording statoscope, does not constitute any novelty per se, but the utilization thereof together with the sun-chronometer-compass complex is substantially different. In effect, according to the already known methods, the statoscope is used to avoid the longitudinal flexion of the assembly of ground models, as reconstructed in the plotting apparatus by the elimination of the vertical parallaxes, being mainly derived from the difference of distortion between the photographic camera and that of the plotting apparatus. To this end, the differences of height furnished by the statoscope for two successive photograms n and $n+1$ of the series, are directly imposed in the plotting apparatus for the corresponding points of survey. The oppositely disposed orientation of the two photograms, the effecting of which is based on the elimination of the vertical parallaxes for the whole field, leads to the determination of the longitudinal inclinations (ψ) of the axes of the photographic cameras, independently of the preceding stations, apart from the accidental and systematic errors (inclination of the barometric level surface) affecting the values furnished by the statoscope. The height of the ground points corresponding to the verticals passing through the points of survey will therefore be subject to height errors, depending on the aforesaid errors of the statoscope.

Furthermore, due to the unavoidable systematic error in the transferring of size from one side of the aerial polygon to the following one, depending on slight optical and mechanical asymmetries of the means employed, the progressive increase (or the decrease) of the size of the grid triangles (formed between the station points and the ground points selected for the connection) determines a progressive error in the height of the model, dependent upon the unvarying imposition of the height of the survey-points in the plotting apparatus, according to the statoscopic data.

In other words, if, for instance, the transferred size error tends to cause a decrease in size of the successive approximately vertical grid triangles, the ground is progressively raised in the plotting apparatus, such raising being equal to a positive error of longitudinal inclination which we will call it. These errors cannot be detected otherwise than by the determining of new ground points.

With the use of the values furnished by the solar device (sun-chronometer-compass) the ground model remains, on the contrary, free from errors of longitudinal flexion, without the aid of the values furnished by the statoscope.

Under such conditions, assuming an error of size transference equalling that of the preceding example, the progressive raising undergone by the ground during restitution will correspond to one-half of the longitudinal inclination it met with when the statoscope is made use of, while the station points will undergo a progressive sinking corresponding to a negative longitudinal inclination, likewise equalling one-half of it. The comparison of the heights obtained in the plotting apparatus for the successive survey points of a first portion of the grid with the values obtained from the statoscope, is therefore capable of furnishing the necessary elements for revealing an error of size transference by enabling a correction beforehand as regards the remaining portion of the grid. The function of the statoscope as a detector of size transference errors, rendered possible through the combination thereof with rest of the mechanism of the device forming the object of the present invention is therefore substantially new as compared with what has been made known until now.

The method indicated above in which use is made of the device in question, in the form as described so far, presupposes that the axis of the camera which photographs the ground and that of the camera which photographs the sun, are coincident, or at least parallel. Assuming that the axis of the solar camera and that of the terrestrial camera form a certain angle, the ground survey or photograph obtained in the plotting apparatus proves inclined by the value of said angle. It is true that when any known ground points are available in the first pairs of photograms, the defect of parallelism of the said axes may be observed and variously compensated on the survey photograph, but it is also true that it is of the utmost interest to be able to counterbalance this defect with means belonging to the machine,

which makes it unnecessary to have these points of control on the ground.

In a further form of execution of the invention, the object aimed at is precisely that of effecting the compensation of the defect of parallelism between the axis of the solar camera and the axis of the axis of the terrestrial camera. In the said form the device comprises an assembly of mechanisms which permit the causing of the rotation of the whole photographic complex about its own vertical axis by 180° for each successive photograph of the ground, so that the eventual angle formed between the axis of the terrestrial camera and the axis of the solar camera shall find itself disposed first in one direction and then in the opposite direction. This rotation further allows of the compensation of the defects of projection as well, depending on anomalies of the photographic camera and of that of the plotting apparatus.

As it is advisable, for the purpose of thoroughly compensating all the anomalies of the solar camera, that the same objective operate in the two opposite positions, in the further form of execution the nine objectives of the solar camera are substituted with a single objective of a wide outer field angle. This objective may be of the type already known, constituted by a negative lens placed before a normal objective. In fine, as the rotation of the photographic complex by 180° for each successive ground photograph may be secured through the continuous rotation thereof, and as this rotation would tend to generate a harmful forward movement both of the rose of the magnetic compass and on the graduated circle of the gyroscopic dirigent, the further form of execution provides suitable transmission gearings which, by causing the rotation in opposite directions both of the compass-box and of the gyroscope dirigent, attain the object of maintaining same constantly oriented.

The object of the invention is illustrated by way of example in Figs. 1–11 which represent a first form of execution of the photographic film camera, and of the relative photogoniometer, and in Figs. 12–20 in a further form.

Fig. 1 represents in vertical section, according to the first form of execution, the surveying apparatus in connection with a standard aerophotogrammetric camera;

Fig. 2 represents an example of the various images impressed on the film with the said apparatus;

Figs. 3, 4 and 5 represent a few details of the solar camera shutters;

Fig. 6 represents the magnetic compass graduation;

Fig. 7 represents the geometrical principle of the device;

Fig. 8 represents the solar camera seen in vertical section;

Fig. 9 represents the said solar camera in a plan view and partly in horizontal section;

Fig. 10 represents the photogoniometric apparatus in vertical section;

Fig. 11 represents the said photogoniometric apparatus in a plan view;

Fig. 12 represents the ground inclination as platted when an inclination or tilt exists between the solar camera axis and the axis of the terrestrial camera;

Fig. 13 shows the setting of the photographs obtained with the device in the further form of execution;

Fig. 14 shows an objective detail according to the further form of solar camera;

Fig. 15 shows the photographic surveying apparatus corresponding to Fig. 1 according to the further form of execution;

Fig. 16 shows a horizontal section on line A—B of Fig. 15;

Figs. 17 and 18 show the setting of the first pair of photograms in the plotting apparatus camera, and

Figs. 19 and 20 show the setting of the second pair of photograms in the plotting apparatus.

According to the example shown in Figs. 1 to 11, the surveying apparatus (Fig. 1) is composed of the solar camera 1 placed upon and connected to the box 2 containing the film spool with the appertaining forward movement and unwinding devices, and the magnetic compass. The box 2 is superimposed upon the parallelepiped box 3 which contains the statoscope, the gyroscopic compass and the electromagnetic device for controlling the several shutters. The box 3 is connected at its lower part to a normal aerophotogrammetric camera 4, represented schematically, by way of example. The sun photography camera (Fig. 8) is composed of a rectangular box 1, to the lower part of which there is affixed a frame 5, which carries a glass having plane and parallel surfaces 6. The lower surface of this glass constitutes the main focal plane for a central objective 7 and for eight objectives 7′ arranged in a circle around the latter. The said nine objectives are carried by the plate 8, affixed to the inside of the box.

The film 9 is destined to collect the images formed by the said objectives. In front of each of the eight peripheric objectives 7′ is placed a prism 10, which deflects to the extent of 60°, outwardly, the main axis of the said objective. The eight prisms are secured laterally to one another in accordance with vertical contacting surfaces forming angles of 45° relatively to one another. Over the central objective 7 there is situated the guard-glass 11 held together with the prisms 10 of the cage 12 affixed to the upper wall of the box 1. The available field in a vertical direction for each of the peripheric objectives 7′ lies 25° below and 30° above the main axis, with a deflection of 60° from the vertical. In the horizontal direction, the field available for each of the said objectives is 45°. To the central objective 7 there appertains an octagonal field, whose section, in the plane of Fig. 1, is 60°. As the actual angular field of each of the aforesaid objectives is somewhat in excess of the one indicated above, a slight margin of overlapping results between the available fields of any two contiguous objectives so as to guarantee that solar disk shall always be photographed on the film 9 provided that it be enclosed within a spherical calotte of an amplitude of 170°. The distance between the various objectives is reduced to the minimum value depending on the dimensions of same and of those of the prisms 10, as the respective fields overlap one another largely within the camera. The original arrangement resulting herefrom is rendered possible by the fact that the subject to be photographed (the sun), allows of the apertures of the shutters 7—7′ being considerably reduced and, eventually, of the screening of the light with coloured filters, disposed, for instance, outside the prisms 10 and the glass 11.

The nine objectives may therefore all be opened simultaneously without any fear of the film being damaged. As the telescope appertaining to the photogoniometric apparatus (which will be de-

scribed) may be approximately oriented in accordance with the known general surveying conditions, the condition is ensured of enabling the observation of the sun-image through the objective whereby same has been produced. The original arrangement of the eight prisms and the relative objectives constituted per se a considerable technical improvement as compared with already known devices realized for obtaining photographs of the sun, the use of which called, in each instance, for the approximate orientation towards the sun of the solar camera itself, or of auxiliary organs, such as prisms or the like, with a view to conveying the sun-image into the field of the photographic camera.

The use of the new device proves, furthermore, simpler it eliminates the causes of error depending on the auxiliary rotary organs of the known devices.

The shutter of the nine solar objectives is formed of a thin metal plate **13** (Figs. 8, 3, 4) through which are bored nine holes **7—7'** set in relative positions corresponding to those of the nine objectives. To the plate **13** is welded the cam **13'** provided with a groove within there acts the extremity of the lever **14** fixed to one end of the shaft **14'** (Fig. 9). The shaft **14'** is rotatable upon two supports fixed to the plate **5** and carries at the other end the lever **14''** to which are clasped at the upper part thereof the spring **15** (Figs. 1 and 9) and at its lower part a steel wire terminating in the ring **16**. The spring **15** acting on the lever **14''** tends to keep the shutters closed, while the traction exerted upon the ring **16** brings about the opening of same according to the position represented in Fig. 8.

The shutter-plate **13**, Fig. 4, presents furthermore the holes **17'***a* and **17'***b*, which determine the passage of the light from the openings **17***a*, **17***b*, Fig. 8, produced in the cover and provided with two small silver-coated or varnished glasses upon which are engraved a small circle and a small cross, respectively, which are transparent. By means of the lozenge prisms **18**$_a$, **18**$_b$ and of the underlying objectives, the images of the small circles and crosses are impressed on the film at *m* and *n* (Figs. 2 and 8). These images constitute the so-called "repère" indexes and serve the purpose of permitting the successive re-establishment of the film position during the use of the photogoniometer. The shutter-plate **13** further presents the perforations **19'**$_a$ and **19'**$_b$ (Fig. 4), which determine the passage of light through two holes pierced in the box-cover **1** in the corresponding positions **19**$_a$, **19**$_b$ (Fig. 9). In correspondence with these two holes there are arranged within the box **1** two vertical tubes, of which that marked **20**$_a$ is to be seen in Figs. 8 and 9. On passing into this tube, the light is doubly reflected by the prism **20'**$_a$ so as to illuminate from below upwards a portion of the magnetic compass rose **21** (Fig. 8). As the rose graduation may be engraved, for instance, on transparent material, the objective **22** conveys the image thereof to *a* on the film **9**. To the vertical tube situated below the hole **19**$_b$ there corresponds a prism similar to that marked **20'**$_a$ (represented by the dashes in Fig. 9) so that on the film **9** there is also formed at *b* the image of a portion of the rose, disposed at an angle of 180° relatively to the preceding portion.

More simply, the rose of the compass **21** may consist in a thin metal plate into which there are cut small notches, from **10** to ten sexagesimal degrees. A number of auxiliary perforations, disposed, for instance, according to Fig. 6, permit the values of the "tens" of degrees corresponding to the photographed notches to be recognized.

The shutter plate **13**, (Fig. 4), finally presents a hole **21'** which determines the opening of an objective **24**, (Fig. 8). This objective, through the medium of an underlying lozenge prism and of the prism **25** located above, conveys to *c* on the film **9** the image of a small chronometer **26**.

To each traction of the ring **16**, exerted for a very short space of time by an electromagnetic device, which will be described; there would therefore be impressed upon the film **9** the image of the sun, that of the so-called "repère" indexes *m*—*n*, those of two diametral portion of the rose of the compass **21** (*a*—*b*) and that of the dial-plate of the chronometer **26** (*c*) Fig. 8.

The said photographs, according to the general principle already described, would be effected at each of the moments when the main camera takes a ground photograph.

But as the rose of the compass **21** is subject to oscillations, the device permits the obtaining of the diagram concerned by means of nine supplementary photographs, intercalated between those corresponding to two successive ground photographs. To this end, the film instead of running continuously for one time only, along the length extending from *m* to *c*, corresponding to the total field, advances at ten different times, equivalent to $\frac{1}{10}$ of the said length, alternating with as many stopping positions during which the electromagnetic device acts on the shutter-plate **13** for the purpose of enabling the taking of as many photographs of the compass. In order to avoid the taking—in the nine supplementary positions—of photographs of the solar disk and of the chronometer as well, there is arranged underneath the plate **13** an occulting plate **27**, Fig. 5, provided with holes corresponding to the positions of the nine objectives **7** and **7'** and of the objective **24**. In register with the objective **17***b* a slot is provided. The sliding of this plate is controlled by the levers **28—28'** (Fig. 8) through a cam **56** connected to the film-unwinding cylinder. Within the box **2** the film to be exposed is unwound from the spoool **29** and passes successively round the roller **30**, between the glass plates **6** and **31** (where it receives the impression), on to the roller **32** and is finally wound round the spool **33**. The roller **32** is destined to cause the film to move forward by sections. To this end, two rollers **34** being integral with the shaft **35**, are driven against the shaft **32** by the springs **36** in order that the film way be compressed between the said rollers. Upon the shaft **35** is mounted the toothed wheel **37** which remains in mesh with the wheel **38** being integral with the roller **32**. The rotation of the rollers **34** is controlled by the rotation of the roller **32**, through the wheels **37—38**, so that the rollers **34** themselves also become motors with a view to the effecting of the forward movement of the film. The wheel **37** through the medium of the three intermediate gears **39—40—41**, transmits the motion to the recuperating spools **33**. The toothed wheel being co-axial with the spool **33**—as in all apparatus of this kind—is not integral therewith, but is mounted frictionally so as to permit the winding of that amount of the film only as is supplied by the motive rollers **32** and **34**. The rotation of the roller **32** is obtained

through the action on the toothed wheel **42** of the small cam **43** carried by the sleeve **44**. The reciprocating motion of the sleeve **44** is obtained by means of the connecting-rod **45** and of the eccentric **46** being integral with the shaft **47**. The latter is, in turn, driven by the vertical shaft **48** through the couple of bevel gears **49—50**. As the wheel **42** is provided with ten cogs, at each revolution of the shaft **47** the film advances $\frac{1}{10}$ of the circumference of the roller **32** and in ten revolutions it advances by the length corresponding to the section *m—c*. In order that the film **9** may remain smoothly in contact with the glass plate **6** during its exposure, the lower glass plate **31** is mounted in a metal frame carried by the framing **51** by means of the bolts **52**. The framing **51** is supported on one side by the bolts **53** fixed to the box **2**, and on the other, by the appendages **54** resisting upon the eccentrics **55**, being integral with the shaft **47**. During the dextrous rotation of this shaft and the period of the stoppage of the forward movement of the film (return of the connecting-rod **45** towards the right) the eccentrics **55** cause the pressing of the film against the glass plate **6**. At the edge of the roller **32** a projection **56** acts on the lower appendage **28'** of the lever **28**, already described, so as to move the occulting plate **27** towards the right and to permit the opening of the solar objectives **7—7'** and of the chronometer objective **24**, once every ten partial forward movements of the film. In Fig. 2 are shown the various images formed on the film. There may be noted thereon the images, *m* and *n* of the so-called "repère" indexes, and the images *a—b* of two diametral portions of the compass graduation, in the ten positions corresponding to the partial forward movements of the film, while the images of the sun *s'* and of the chronometer *c* appear once only; in the period corresponding to the ground photography. At the film upper part there may also be noted, for each of the ten positions assumed thereby, the images *g* of a portion of the gyroscopic compass, and the images *p* in the form of a segment which illustrate through their shifting on the film, the slight pressure variations measured by the statoscope. These latter images *g—p* are thrown upon the film from below through the mirror **57** which is supported by the part **58** fixed to the box **2**. The said images proceed from special contrivances arranged within the lower box **3** to which the box **2** is rigidly connected by screws, in correspondence with the cams **59**. The box **3**, Fig. 1, carries laterally, at its upper part, a small box **60** which is fitted through a suitable guide-way against one of the walls of the box **2** in register with an opening which permits the mirrors **61—62** to throw back upon the mirror **57** the images of the gyroscopic compass and of the statoscope. A part of the box **60** is visible in Fig. 9 likewise. The statoscope, Fig. 1, is composed of a vacuum case **63** whose free wall acts on the tall-piece of a rotatable mirror **64** so that the slight atmospheric pressure variations cause corresponding rotations of the mirror. The case support **65** carries an objective **66** and a small box containing a small electric lamp **67**. A narrow slot **68** is cut in the upper wall of the box and the focus of the objective **66** so arranged that the slot image shall be formed on the film **9** through the successive reflections to the mirrors **64—61—62—57**. The slightest pressure variations are therefore recorded on the film with the shifting of the slot image. The said shiftings may be measured by any means, relatively to the central line defined by the indexes (repères) and a sampling may allow of the reception of the corresponding atmospheric pressure variation values. The manipulation from the outside of a button **69** provided with a disk **69'**, graduated according to the altitude concerned, allows of the conveying—at the starting of the flight—the image *p* of the slot **68** to an approximate fundamental position. The gyroscopic compass is constructed according to already known models, being composed for instance of a closed box **70** from which there starts an air-port **71** which there is connected a vacuum pump or a Venturi tube suction-tube, so as to draw a strong current of air out of a blast-pipe **72** which causes the rapid rotation about a horizontal axis of a small turbine constituting the gyroscopic mass. The axis of this small turbine is supported by a horizontal ring, supported, in turn (in the direction of a horizontal axis being normal to the preceding one), by a fork **73** that is rotatable about a vertical axis. This fork carries externally a ring **74** upon which a graduation is engraved. One wall of the gyroscope-containing box **70** is provided with a glass to which is fastened a small prism **75** destined to illuminate a portion of the graduation **74** by means of the lamp **67**. In correspondence with the illuminated portion, an index or nonius carried by the box **70** permits the reading off of the graduation indication. An objective **76**, with the aid of the mirrors **77—78—61—62—57**, produces on the film **23** the image of the illuminated portion of the graduation and of the relative index or nonius. The formation of the images of the slot for the statoscope and of the gyroscope graduation at the pre-determined moments, is effected through rapid lightings of the lamp **67** by means which will be described.

The box **3**, supports, by means of the bolts **79** and of suitable stays, the aerophotogrammetric apparatus **4** which, as already stated, is one selected from among already known types. In the connection of the apparatus **4** with the box **3** it should be ensured that the focal plane **80** (Fig. 1), of the apparatus and the focal plane **6** of the solar camera shall be parallel, with good approximation. The apparatus should, furthermore be selected from among those plate or film cameras in which the unwinding of the film (or the changing of the plates) and the winding up of the shutter are automatically effected through the turning, from the outside, of a cranked handle or the like, a determinate number of entire revolutions, for a cycle corresponding to the taking of a photograph. This external actuating organ has been represented by way of example by the cardan transmission **81—81'**. The said photographic apparatus must further be provided with an electromagnetic device for causing the instantaneous opening of the shutter of the appertaining objective, the circuit of which shall terminate, for instance, at the connectors. As aerophotogrammetric cameras provided with such device are already known, we will not describe the relative mechanisms thereof, which are to be understood to be excluded from the present invention. In order to the securing of synchronism between the running of the device forming the object of the present invention and the running of the apparatus **4**, a box **83** is provided containing two bevel gears by means of which the continuous rotary motion of a shaft **84** is simultaneously transmitted to the apparatus **4** and to the said

device by the transmissions 81—81′ and 85—85′. The transmission 85—85′ causes, through the gears 86 (ratio 1/1) the rotation of the shaft 87, which is extended at the upper part, through the box 3 becoming connected through the joint 48′ to the shaft 48 (Fig. 8). As the ratio between the gears 49—50 is equal to 1/2, 20 revolutions of the shaft 87, and therefore of that marked 84 also, are required in order that the roller 32 may perform one entire revolution. The ratio between the gears contained in the box 83 must be determined according to the camera at one's disposal. In the example of Fig. 1 the ratio 1/1 corresponds to the case in which 20 revolutions are also required to enable the apparatus 4 to complete an entire cycle. The shaft 87 terminates at its lower part in the tangential screw 88 which acts on the worm-wheel 89 so that the latter performs one revolution for every 20 turns of the screw. The wheel 89 is provided laterally with a star-disk having ten points, which, at each tenth of a revolution, cause the closure at 90 of an electric circuit comprising the battery 91 and the electromagnet 92. The latter, when the circuit is closed, attracts the armature 93, which, by means of the hook 94 carries along with it the lever 95. The end of this lever is connected by a steel wire to the ring 16 controlling the solar camera shutters (Fig. 8). Towards the end of the downward rotation of the lever 95 the lower appendage of the hook 94 strikes against the end of the support of the electromagnet 92, causing the disengagement of the lever 95 which is urged upwards again by the spring 15, (Fig. 8). The opening of the objectives effected by the shutter 13 is therefore instantaneous, independently of the closure of the electric circuit 90—91—92. The lever 95 is further provided with a tail-piece, carrying a metal tongue 96, insulated therefrom, by means of which there is closed an electric circuit comprising the battery 97 and the lamp 67 having the functions already described. The instantaneous lighting of the lamp 67 therefore occurs simultaneously with the opening of the solar shutters. The closure of the circuit at 96 brings furthermore about, through the medium of an insulating cam, the closure at 98 of an electric circuit comprising the battery 99 and the interrupter 100 which terminates at the binding-screws 82 of the inner circuit of the apparatus 4. The complete closure of the circuit of the apparatus 4 occurs in one position only of the wheel 89, in which, through the effect of a special eccentric mounted there upon, the interrupter 100 is also closed. The regulation of the transmission of the various movements is so effected that the closure of the circuit of the apparatus 4, and therefore the opening of the appertaining shutter, shall occur during the most suitable period of the cycle of the said apparatus and during one of the stoppages of the advance of the film in the solar camera 1.

The continuous rotary movement of the shaft 84 controlling the whole device, may be obtained through a variable speed electric motor, or else through a regulatable pitch fly, selected from among already known types. The whole device may be cardanically suspended by means of the gimbals 101, 102, while it may turn relatively to the fixed gimbal 103 in order to correct the deviation. A number of elastic tie-rods 104 may limit the pendulating oscillations about the joint 101—102. The aeroplane fuselage must be provided with an upper aperture adapted to permit the taking of sun photographs and with a lower aperture for ground photography.

To recapitulate—the photographic surveying apparatus as described by way of example, permits the taking of photographs of the sun, of a chronometer, of two compasses (one magnetic and the other gyroscopic) and of a statoscope at each of the moments when the main camera takes a ground photograph. Furthermore, in the interval between one photograph and the next following the apparatus allows of the taking of nine further auxiliary photographs of the two compasses and of the statoscope.

The photogoniometric device forming an integral part of the surveying apparatus, is represented in Figs. 10 and 11. It comprises a box 105 containing a glass plate 106 supported by four springs 107 fixed to the box sides and a set of lamps 108 for the illumination of the film. The film obtained by means of the camera as described, is wound, after necessary operations of developing, fixing and drying, on to the spool 109 from which it is unwound in order to pass on to the glass 106 and to be taken up by the spool 110, as the photogoniometric measurements are made, one after the other. With a view to immobilizing the film in each position approximately corresponding to the duration of an exposure, the screws 111 acting on the cams 112 are tightened. By the unscrewing of the four buttons 113 (Figs. 8 and 9) connecting the box 2 to the solar camera 1, the latter may be removed from the photographic apparatus and mounted on the photogoniometer box 105, as is apparent from Figs. 10 and 11. The chronometer 26 and the prism 25, together with their support, may be removed from the solar camera by unscrewing the screw 114. There may then be applied on the solar camera the photogoniometric device properly so-called, which is constituted by the fixed ring 115 upon which rests the ring 116, rotatable upon balls. The ring 115 is integral with the ring 117 which carries a helicoid teeth-rangs acted upon by the tangential screw 118 carried by the ring 116. The turning of this screw by means of the appertaining button, occasions the rotation of the ring 116 while a microscope (estimation microscope, for instance) 119 carried by same permits the angular readings of a graduated ring 120 integral with the solar camera. The telescope 121, destined to effect the pointing at the sun image is carried by the bridge 122 rotatable on the pivots 123—123′ (Fig. 10) about an axis normal to that of the ring 116. A graduated sector 124, also carried by the ring 116 is provided with a helicoid teeth-rack 125 acted upon by a tangential screw 126 carried by the support 127 connected to the bridge 122; wherefore the turning of the screw 126 causes the turning of the telescope about the axis 123—123′, while an (estimation) microscope 128 carried by the support 127 permits the effecting of angular readings on the graduation 124. The telescope 121 is therefore endowed with two angular movements, one which will be termed azimuthal in the plane of the ring 116, or about the normal to the focal plane 6; the other, which will be termed zenithal, about the axis 123—123′. The origin of the graduation on the sector 124 is so established that the microscope 128 shall observe zero when the telescope axis is normal to the focal plane 6. The telescope 121 is, as a rule, adjusted for infinity. The axis 123—123′ is decentred relatively to the axis V P of the solar camera in order to permit the telescope lens to collect the rays proceeding

from two or three solar objectives 7—7′ in the conjunction zones of the relative fields of view. In order to secure the re-establishment, as regards the solar camera, of the positions assumed by the film during the successive exposures, the small tubes which in the camera carry the small glasses 17a—17b (upon which a small black circle and a small black cross are, respectively, engraved upon an opaque background) are replaced by the small tubes 17′a and 17′b carrying small glasses upon which a small black circle and black cross are respectively engraved upon a transparent background. As soon as the film has been fixed in an approximate position by means of the binding screws 112, the screws 129 are acted upon, thus causing the solar camera to perform slight shiftings relatively to the film until the small circle and cross (repères) images m—n are brought by the objectives 18a—18b into correspondence with 17′a and 17′b. The coincidence is observed at 17′a through the microscope 130a whilst it is observed at 17′b through the microscope 130b, which is brought into the correct position through the rotation of the arm 131 and subsequently excluded in order to permit the complete zenithal rotation of the telescope 121.

The connection between the solar camera and the ground photography camera 4 is established in such a manner that the microscope 119 points to zero on the graduation 120, when the plane in which the telescope 121 rotates zenithally is parallel to one of the axes of the photogram in the camera 4, defined, for instance, by the (so-called repères) indexes i—i' of Fig. 7. Considering, in this figure, the centre of sight relating to the solar objective (utilized) to be hypothetically coincident at V with that of the camera 4, and at F the (positive) ground image, the angles $\alpha\phi_p$ shown in the figure correspond, respectively, to the azimuthal angle read off the graduation 120 and to the zenithal angle read off the graduation 124, during the collimation to the sun image on the film. In order to the effecting of the reading off the azimut indicated by the magnetic compass the ring 116, (Figs. 10 and 11), carries, by means of a support 132, a special microscope 133, composed of a tube within which are arranged the right prism 134—135 and the objectives 134′—135′ which bring the images b—α of the diametral compass graduations in to the focal plane of an eye-lens 136 wherein a vertical thread index is disposed. The angular movements of the microscope 133, required for obtaining the collimation, are effected through the turning of the screw 118, while the angular readings are still effected by means of the microscope 119. Instead of two successive collimations at a and a—b being effected, and therefore, two angular readings, the simultaneous collimation at both points may be obtained through the tube of the microscope 133 being rotated about its own axis by means of the appendage 137, which eliminates the rose eccentricity effect. As the azimuthal angle formed between the axis of the microscope 133 and the plane of movement of the axis of the telescope 121 has a known constant value γ, and as the value is also known, in tenths of degrees Cr corresponding to the couple of collimated compass marks a—b, the reading of the angle β effected with the microscope 133 permits the reception of the magnetic azimut ($\theta\ i^1m$) at the valve for the photogram axis i—i' by means of the algebraic sum $\theta i^1 m = Cr(\beta+\gamma)$. The magnetic azimut, corrected by the known local declination and by the eventual deflection induced by the magnetic masses on board, assumes a value θi^1 expressing the geographical azimut assumed by the axis i—i' of the photogram of the camera 4, at the moment of exposure (Fig. 7). By the addition to the angle θi^1 of the azimuthal angle α read off the photogoniometer in the collimation to the sum image S^1, the azimuth θ_p is obtained of the plane containing the solar direction and passing through the periscope axis (and hence through the axis of the camera 4) ($\theta i^1+\alpha=\theta_p$). The azimut θ_p would be identified with the true solar azimut θ_s (obtained together with ϕ_p of the astronomical calculation, being based on the time of day when the photograph was taken and on the approximate geographical coordinates of the camera station) should the periscope-camera axis P V P ^{1} lie in the vertical plane Z V S.

Instead, there generally exists a difference ($\theta_s-\theta_p=\epsilon$) that may be transfered with sufficient approximation to the horizontal plane N R K and which, precisely, permits the calculation of the angle λ forwed between the two planes P V S & Z V S. In effect, by resolving the spherical right angled triangle S K E, at K (known: SK$=90°-\phi_s$ and ϵ) it is possible to ascertain the value of the angle λ. By successively resolving the spherical oblique angled triangle ZPS (known: ϕ_s, ϕ_p and λ) the angle at Z and the side ZP may be calculated. The angle at Z expresses the azimutal difference between the vertical plane ZS (of known azimut θ_s) and the vertical plane ZP containing the periscope axis V P, while the side ZP expresses the value of the inclination of the said axis relatively to the vertical V Z. In fine, the value of the angle at P, that may be deduced from the said triangle Z P S, subtracted from the angle α, expresses the swing of the axis i—i' of the photogram F (orientation) relatively to the plane PVZ, of already known azimut. In case there should, instead, be pre-established a restitution azimut VR$=\theta_s+\delta$ (corresponding, for instance, to the component x of the aerial base and to the axis X of the plotting apparatus writing table) there being predisposed in the said apparatus in order to the outer orientation of the photogram, as the primary axis that of transverse inclination τ, coinciding with the bass component x, as secondary axis that of longitudinal inclination ψ, and as the tertiary axis that of the swing (ω), the calculation may proceed as follows:—First the right-angled triangle SKE is once more calculated, from which there are deduced the values of the angle $\hat{E}$ and of the side SE (p). Thereupon the triangle P E R is calculated there being known the side E R$=\epsilon+\delta$, the angle $\hat{E}$ and the side P E$=\phi_p+p$ from which the values of the angle at R, of the side RP and of the angle at P. The value at R defines the value of the transverse inclination τ of the periscope-camera axis (PVP^1) referred to the horizon RE. The side RP expresses the value ψ of the longitudinal inclination, referred to V R and the angle at P, added to the angle α, defines the value (ω) of the swing of the axis i—i of the photogram referred to the plane PR.

As the value of the angle ϵ is approximate, inasmuch as it proceeds from an azimut furnished by the compass a fresh calculation of the aforesaid triangles S K E and P E R may be effected, a new value being attributed to ϵ, varied, for instance by ½ a degree. There will thus be obtained a new trio of values ($\omega'\psi'\tau'$) whose differ-

ences ($d\omega d\psi d\tau$) with the preceding values, allow of the establishing of the incremental ratios

$$\frac{d\psi}{d\omega}, \frac{d\tau}{d\omega}$$

and between a slight variation of swing and the consequent variations of longitudinal and transverse inclinations. According to the mode of procedure already described, as soon as the first pair of photograms (I & II) has been placed in the plotting apparatus, containing the starting base, with the primitive angular values ($\omega I \psi I \tau I$, $\omega II \psi II \tau II$) the swing of each photogram is rectified on the said base, and the variations of swing ($\Delta\omega I \Delta\omega II$) obtained, which on being multiplied by the aforesaid incremental ratios, permit of the rectifications being made in the longitudinal and transverse tilt, the definitive correct angular setting of each photogram being thus obtained, as if each of same had actually turned during the rectification of the swing, about the appertaining solar direction. The proportioning of the optical model on the starting base is effected in the ordinary way while the connection to the successive photograms is realized in the manner already indicated by means of rectifications of the swing of each photogram relatively to the preceding one and the consequent incremental rectifications in the longitudinal and transverse tilt. The size transfer from one model to that next following is effected in the already known manner, by means of the height of a feature selected in the zone of conjunction of two successive models.

The use of the gyroscopic compass is effected as follows:—After the first pair of photograms has been placed on the starting base, there are obtained from the plotting apparatus the values of the actual swingings ($\omega I \omega II$) of the axis i—i' for the said photograms, which enables the determination of the initial state of the gyroscopic compass. After the final pair of the series has been placed in the plotting apparatus, on the arrival base, the final state of the gyroscopic compass may be similarly determined and the total precession value then computed. This value, divided by the number of intermediate view points plus one, enables the making of the gyroscopic azimut corrections ϑ for all the intermediate photograms of the series.

When effecting the calculations of the triangles SKE and PER, it is possible with the (corrected) values obtained from the gyroscopic compass, to obtain, in work of limited requirements, to effect the definitive angular setting of the photograms without any incremental corrections having to be made. In case in which it is deemed advisable to rectify the swing of each photogram in respect of the preceding one, the use of the gyroscopic compass enables the attainment of greater precision and rapidity owing to the fact that the extent of the rectifications is reduced.

The statoscope registrations, as already stated, are made use of with the solar apparatus in order to reveal systematic errors in the size transferring from one optical model to the next, by means of the progressive differences made manifest between the heights supplied by the statoscope and those recorded by the plotting apparatus.

The height variations of the view-points furnished by the statoscope may similarly to the already known methods, also be directly utilized for the purpose of imposing on the successive view-points the vertical (bz) component of the air base, in the exceptional cases in which the course of the airplane is nearly normal to the direction to the sun and that the height of the latter above the horizon is inconsiderable. In this case, too, after the said vertical component (bz) has been imposed, the photograms are set in the plotting apparatus according to the angular values ($\omega\psi\tau$) supplied by the solar apparatus. Successively, suitable rectifications of longitudinal tilt ($\Delta\tau$) combined with corresponding rectifications of swing ($\Delta\omega$) and of transverse tilt ($\Delta\psi$) are effected according to the computed incremental ratios

$$\left(\frac{d\omega}{d\tau} \frac{d\psi}{d\tau}\right)$$

until the vertical parallaxes have been annulled for four points of the model approximately situated at the corners. The definite longitudinal tilt for each photogram of the series is obtained in function of the statoscopic values, as in the known processes, but with the simultaneous use of the other elements supplied by the solar apparatus, the swing and the transverse tilt values are defined with considerable exactitude, independently of the corresponding values of the preceding photogram, which constitutes a real progress as compared with what is known.

In the form of execution so far described, assuming that the camera axis instead of being parallel to the solar camera axis forms an angle c with the latter, the plotted ground model proves tilted by the same angle c, as shown in Fig. 12. In a further form of execution (Figs. 13 to 20, inclusively) the surveying photographic complex is caused to rotate alternately during flight by 180°. Thus, (as shown by Fig. 13)—the two halves of the photogram being designated m and n the exposure field m of the photogram o will be found to correspond, on the ground, to the exposure field m' of the photogram **1**, and successively, n' to n and so on, so that the plotted model is not subject to the tilting depending on the defect of parallelism, referred to above, between the terrestrial camera axis and the axis of the solar camera. By this proceeding there are also compensated the defects of projection depending on an erroneous definition of the principal point which is equivalent to a tilting of the photogram relatively to the axis, as shown in the said Fig. 13, and on other anomalies due to optical or mechanical causes, of one half of the field appertaining to the camera m relatively to the other half n. The compensation also takes place in connection with the projection anomalies of the plotting apparatus camera, inasmuch, as is apparent from Figs. 17, 18, 19, & 20, the photograms are rotated by 180° when proceeding from the plotting of one pair to that of the next.

With a view to obtaining the continuous rotation of the photographic complex, the external controlling means instead of terminating at the small shaft **84** of Fig. 1 of the principal patent, terminates at the small shaft **84'** of Fig. 15, which, through the gearing **140**, acts on the spur-gear **141** derived from the ring **102**. The latter is thus able to rotate continuously relatively to the ring **103** (fixed to the airplane) carrying the whole photographic apparatus along with it.

The ring **102** carries an appendage **102'** supporting a cylindrical pinion **142** (Fig. 15) in mesh with a spur-gear **143** carried by the ring **103**.

During the continuous rotation of the whole photographic complex about its own vertical axis, the pinion **142** is compelled to turn, transmitting its motion to the photogrammetric apparatus **4** through the transmissions **81'**—**81**, and to the

solar camera through the couples of gears **83'**—**86**.

As in the example described in the first form of execution, the connecting shafts to the apparatus **4** and to the solar camera were required to perform **20** revolutions in order to the completion of an entire photographic cycle (corresponding to one ground photograph) the ratio between the pinion **142** and the spur-gear **143** must be 1/40 so that to each half-revolution of the photographic complex there corresponds one whole photographic cycle. The various phases of the apparatus may readily be adjusted in such a manner that the release of both the shutters occurs when the pinion **142** is brought into correspondence with two opposite teeth of the spur-gear **143**, situated on a diameter being parallel to the longitudinal airplane axis.

For the purpose of ensuring that at each moment at which a ground photograph is taken one of the sides of the terrestrial photogram shall be found oriented in accordance with the actual course of the plane, the spur-gear **143** may be turned in one direction or in the other of the deviation angle value by means of the pinion carrying the crank **144** which acts on a sector **145** connected to the said spur-gear **143**.

With a view to avoiding any dragging effects on the rose of the compass **21** during the continuous rotation of the photographic complex, the appertaining box **21'** is mounted rotatably and carries the spur-gear **146** round which passes a small continuous chain receiving motion from a pinion **146'** mounted on the small shaft **48** which, according to the first form of execution, acts on the solar camera controlling organs. The ratio of movement between the pinion **146'** and the spur-gear **146** is, according to the said example, 1/40, and the direction of rotation of the box **21'** is opposed to the direction of rotation of the whole complex, whereby the box **21'** is oriented.

With a similar end in view, the support **73'** of the fork **73** of the gyroscope directing means is made rotatable and receives movement through a small chain from a pinion **87'** mounted on the small shaft **87**. Fig. 5 shows, in section, the schematic arrangement being also available for the transmission connection to the compass.

In the plotting apparatus cameras the photograms, corresponding, for instance, to the exposure points o and *l* of Fig. 13, are mounted as indicated in Figs. 17 & 18. To this end, the rings **147** & **148** of the cameras carry, at their upper and lower parts, a pair of projections with supporting counter-screws, which be engaged by each tail-piece of the small photogram-carrying frames **149***a* & **149***b* in an upward and in a downward direction, alternately.

In order to ensure that the photogram **1**, for instance, shall turn by exactly 180° during its passage from the positions of Figs. 17 & 18 to that of Figs. 19 & 20, there is connected to the said small photogram-carrying frame a double curvature level **150** with its relative bubble-centring screws. Suitable reversing organs of known type, previously disposed in the plotting apparatus between the carriage and the writing board enable the preservation of the orientation of the drawing.

The second form of execution further provides a new objective in the solar camera, of an extensive external field of view: same is composed—as shown in Fig. 14—by a negative lens placed before a normal objective. This objective takes the place of the nine objectives according to Figs. 8 & 9 of the first form of execution.

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AUXILIARY AEROPHOTOGRAMMETRIC SURVEYING APPARATUS, INCLUDING THE OBTAINMENT OF PHOTOGRAPHS OF THE SUN AND ENABLING THE REALIZATION OF A NOVEL PROCESS OF AEROTRIANGULATION

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Serial No. 256,012

5 Sheets-Sheet 1

Fig. 1

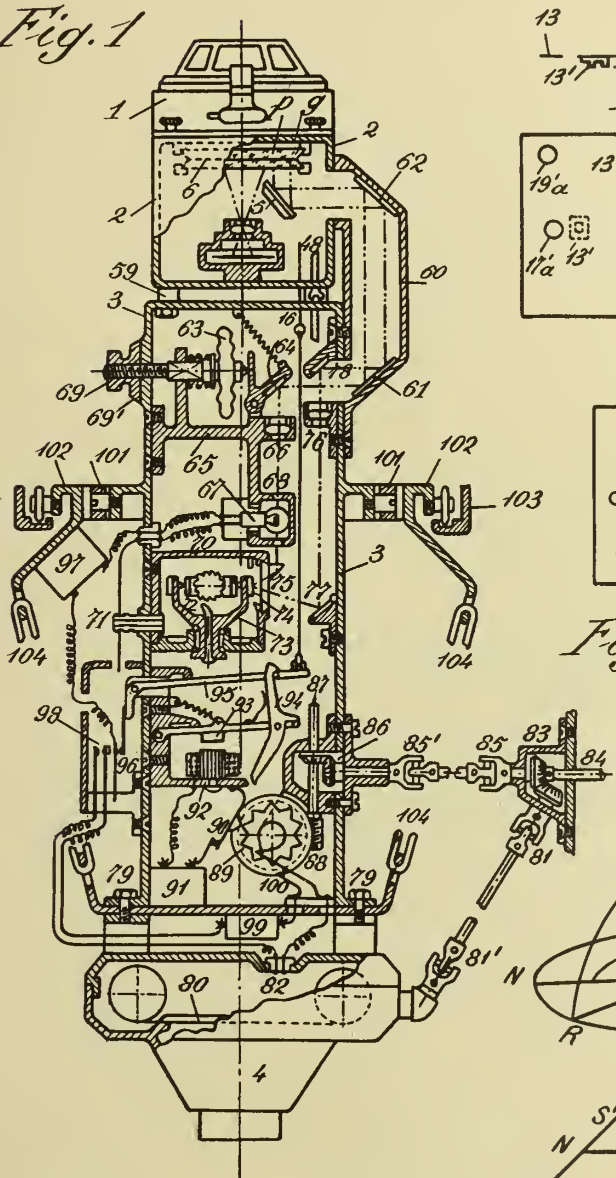


Fig. 3

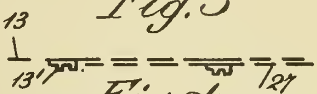


Fig. 4

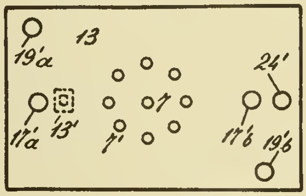


Fig. 5

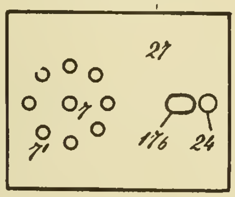


Fig. 6

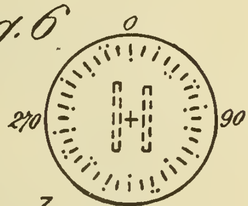
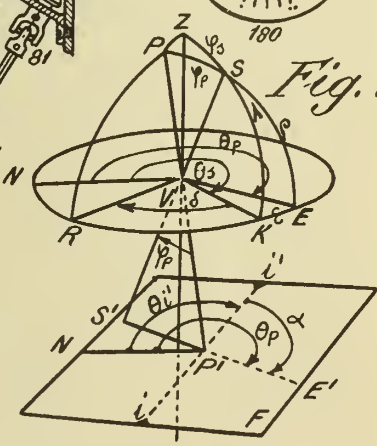


Fig. 7



Ermenegildo Santoni

INVENTOR

By [signature]

his ATTY.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

E. SANTONI

AUXILIARY AEROPHOTOGRAMMETRIC SURVEYING APPARATUS, INCLUDING THE OBTAINMENT OF PHOTOGRAPHS OF THE SUN AND ENABLING THE REALIZATION OF A NOVEL PROCESS OF AEROTRIANGULATION

Filed Feb. 11, 1939

Serial No. 256,012

5 Sheets-Sheet 2

Fig. 2

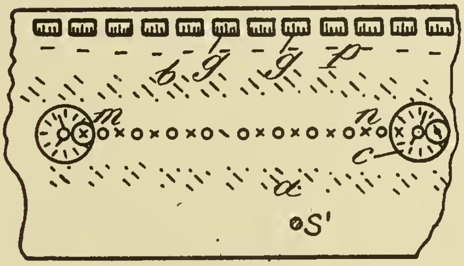
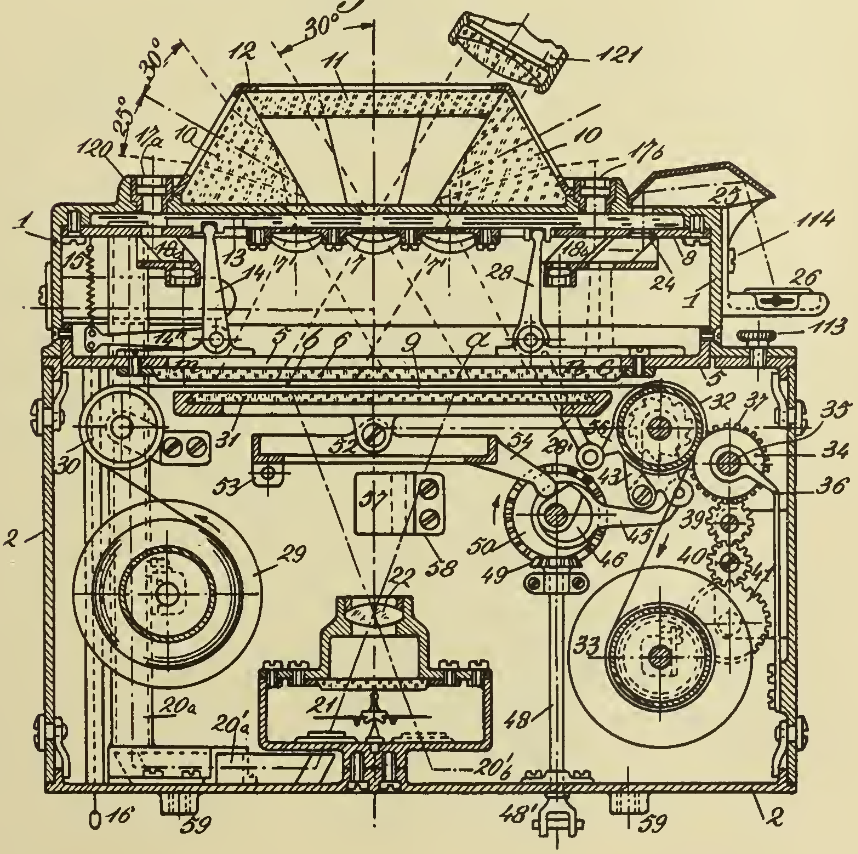


Fig. 8



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Filed Feb. 11, 1939

Serial No. 256,012

5 Sheets-Sheet 3

Fig. 9

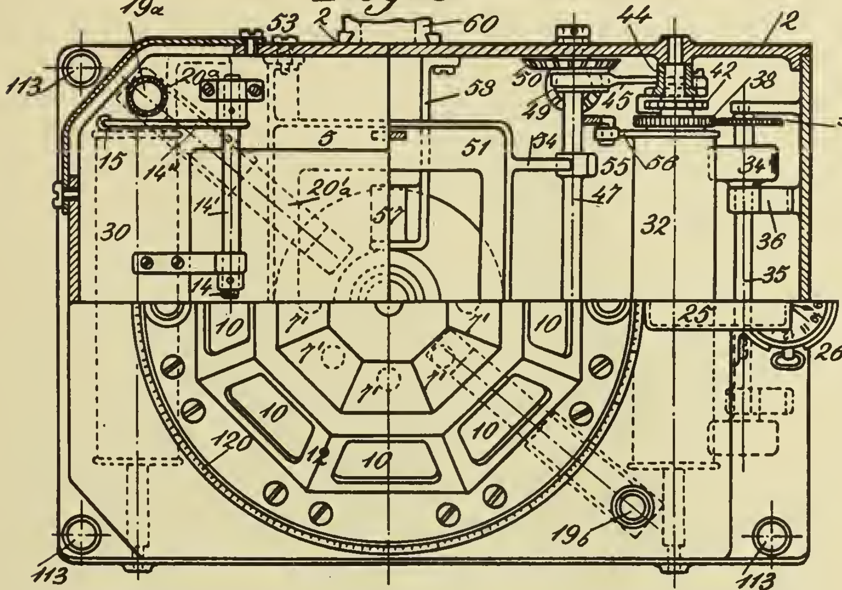
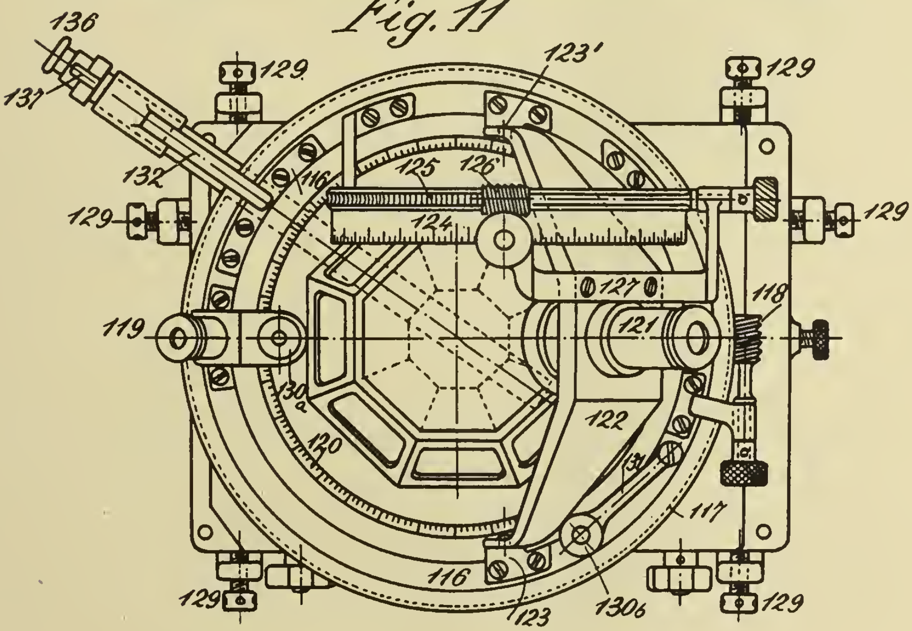


Fig. 11



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Filed Feb. 11, 1939

Serial No. 256,012

5 Sheets-Sheet 4

Fig. 10

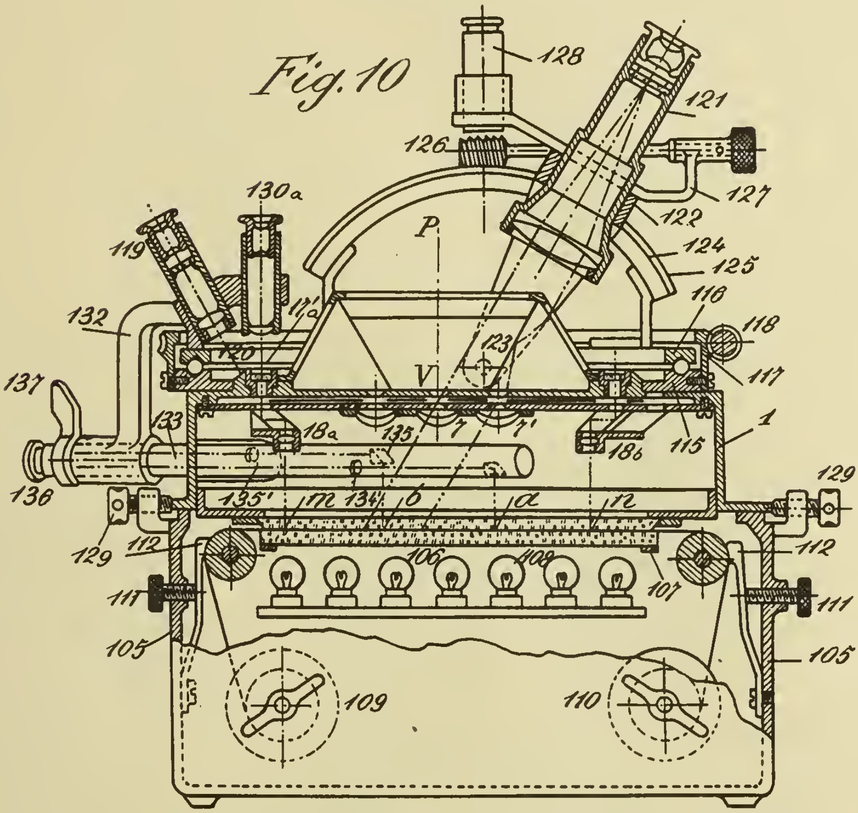


Fig. 12

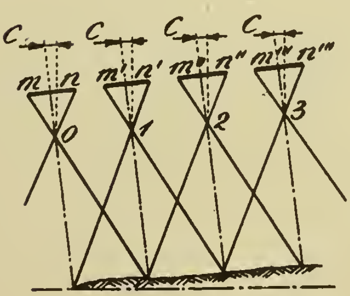
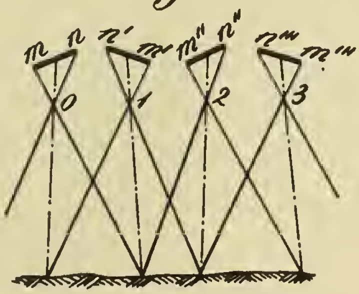


Fig. 13



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PUBLISHED

MAY 4, 1943.

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E. SANTONI

AUXILIARY AEROPHOTOGRAMMETRIC SURVEYING APPARATUS, INCLUDING THE OBTAINMENT OF PHOTOGRAPHS OF THE SUN AND ENABLING THE REALIZATION OF A NOVEL PROCESS OF AEROTRIANGULATION

Filed Feb. 11, 1939

Serial No. 256,012

5 Sheets-Sheet 5

Fig. 15

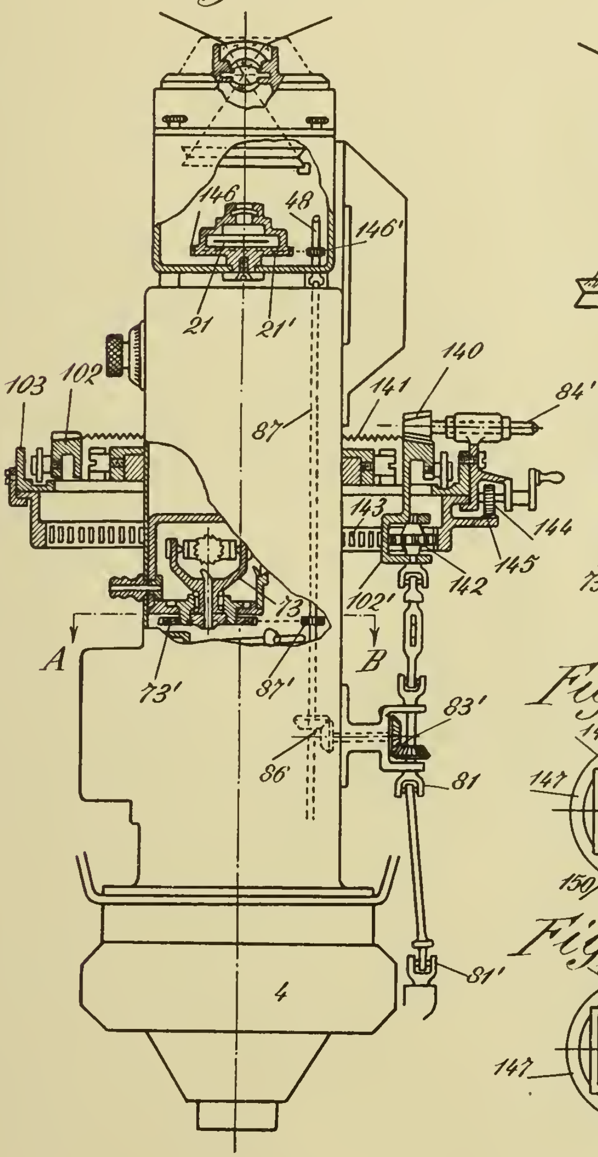


Fig. 14

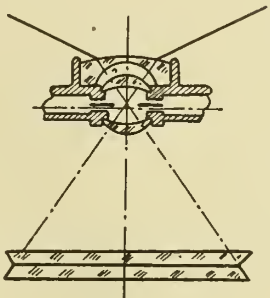


Fig. 16

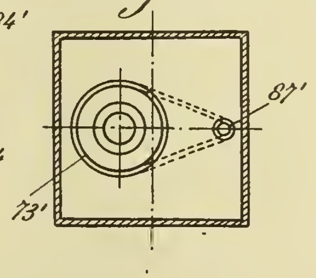


Fig. 17

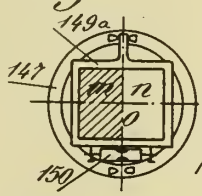


Fig. 18

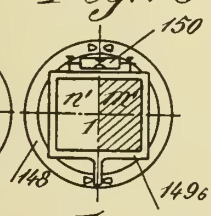


Fig. 19

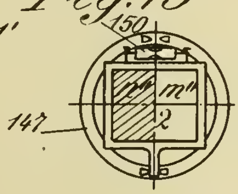
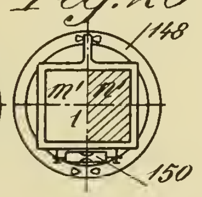


Fig. 20



Ermenegildo Santoni

INVENTOR

By Otto Munk

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Published May 4, 1943 Serial No. 256,875

ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE STRENGTHENING OF SHELTER COVERS

Nicolas Žitkević, Belgrade, Jugoslavia; vested in the Alien Property Custodian

Application filed February 14, 1939

The impact of a bomb on the roof of a shelter causes the penetration of the bomb into the concrete to a certain distance. The penetration is due to the breaking up of the concrete resultant on the impact of the bomb and the crumbling and shifting of the concrete. The latter is caused by the conical head of the bomb which at the moment of impact acts as a wedge and displaces the concrete in every direction.

The explosion of the bomb after impact causes the enlargement of the funnel-shaped hole already formed and causes violent vibration of the concrete particles beneath the hole so formed.

Experience and tests undertaken have shown that the impact and the explosion of the bomb on the vault or covering of the shelter produces the two following spheres of destruction:—

1. In the upper portion a shattering of the structure of the concrete and destruction of the steel reinforcement, which causes the enlargement of the funnel-shaped hole,

2. in the lower portion under the funnel-shaped hole, as the first indication of destruction, a partial falling away of the concrete.

By the increase in the weight of explosive in the bomb, the volume of the concrete displaced is increased, so that its volume may be thirteen times as large as that of the corresponding funnel-shaped hole, as shown in Fig. 1.

The fact of the falling away of the concrete from the under side of the vault or covering is explained by the fact that the explosion causes a violent vibration through all parts of the undestroyed concrete and therefore also underneath the funnel hole. One can explain this fact, as regards this elastic section of the concrete—see Fig. 2—by the simile of a number of elastic balls, so that the violent impact on the first ball causes the displacement of the last ball on the underside of the vault, whenever the strain caused by the vibration is greater than the tensile strength of the concrete.

The above shows that, in the case of shelters made of concrete or reinforced concrete, the greatest danger is caused by the destruction of the inner structure and this insofar as the tensile and shearing strength of concrete is only about one tenth of its compressive strength.

It is well-known that, due to the small and variable tensile strength of concrete, this factor is not taken into consideration in calculations for reinforced concrete construction.

Therefore, in order to strengthen the resistance of vaults or coverings for shelters and for lessening their thickness, the following measures are necessary:—

1. The strengthening of the compressive and shearing strength of the upper part of the concrete, whereby the dimensions of the funnel-shaped hole are rendered less—see Fig. 3*a*—and

2. the strengthening of the tensile strength of the concrete in the lower part to prevent shattering—see Fig. 3*b*.

For this purpose, concrete reinforced with wire, "Felted Concrete", is recommended. In such concrete, thin short iron wires of soft consistency are introduced, in such a manner that they spread in all directions similar to the threads in felt. Such wires are from 1 to 1.2 mm. in diameter and from 12 to 15 cm. long. The wires are uniformly distributed in the concrete, so that its shearing, tensile and compressive strength is considerably increased in every way.

This may be explained through the fact that the use of thin wire gives the greatest possible contacting and adhesion surfaces between the predetermined quantity of iron and concrete. Experience and tests have shown that the comparatively thick iron reinforcements in reinforced concrete construction stimulate the transmission of vibration. By such transmission, the concrete becomes separated from the reinforcement and thus destruction is commenced. This disadvantage is avoided by the present invention.

The thin wire distributed uniformly in the concrete produces the homogeneity of the wire-reinforced concrete with regard to its composition as well as the mechanical conditions.

Therefore this "Felt-concrete" is particularly suited for the construction of columns carrying heavy loads, foundations for steam-hammers and buildings subjected to earthquakes and bombardment. The use of this "Felt-concrete" in the construction of shelter covers decreases the necessary thickness for concrete vaults to 55% to 60% or in the case of covers or vaults of ordinary reinforced concrete to 30% to 35%.

By using wire of from 12 to 15 cm. long and stone ballast of an average of 4 cm., there will be attained:—

1. that each wire encircles or embraces several particles of the ballast.

2. that all wires are uniformly distributed throughout the concrete so that they are in the interstices between the particles, so that each particle is woven around on all sides by the wire. Experience proves that when using 50 kilograms of cut wire to 1 m^3 of concrete, each particle of ballast will be in every direction surrounded by four to six wires,

3. that in the concrete mass all these wires will form a reinforcement, woven into the mass in the manner of felt. The reinforcement is automatically attained at the pouring and ramming of the concrete.

4. that, due to the use of wires of 12 to 15 cm. long, there remains on the upper surface of each rammed layer of concrete a sufficient number of wires, of suitable length, to act as a strong connection with the next layer of concrete.

The most suitable composition of the "Felt-concrete" is as follows: to one cubic metre of concrete containing 400 kilograms of cement, about 50 kilograms of cut soft iron wire of a diameter of from 1 to 1.2 mm., and a length of from 12 to 15 cm. Asphalt bitumen may also be used, instead of cement, as a binding agent.

The method of construction with "Felt-concrete" is as follows: to the prepared plastic concrete, of composition as above, is added about 50 kilograms of cut soft iron wire, of dimensions as given above; these wires are by means of forks distributed as evenly as possible in the mass of the concrete before and during the pouring. In each rammed layer, the end of the wires are drawn out by means of forks in order to assure a strong connection with the next layer of concrete.

NICOLAS ŽITKEVIĆ.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

N. ŽITKEVIĆ
PROCESS FOR THE STRENGTHENING
OF SHELTER COVERS
Filed Feb. 14, 1939

Serial No.
256,875

Fig. 1.

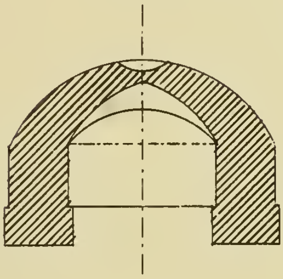


Fig. 2.

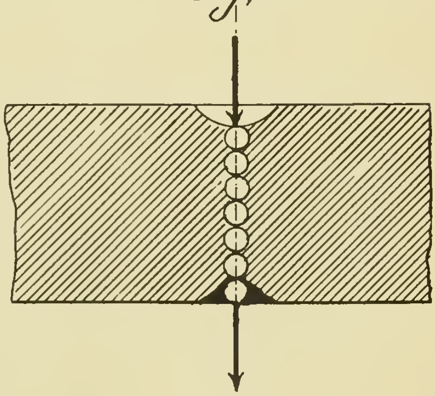
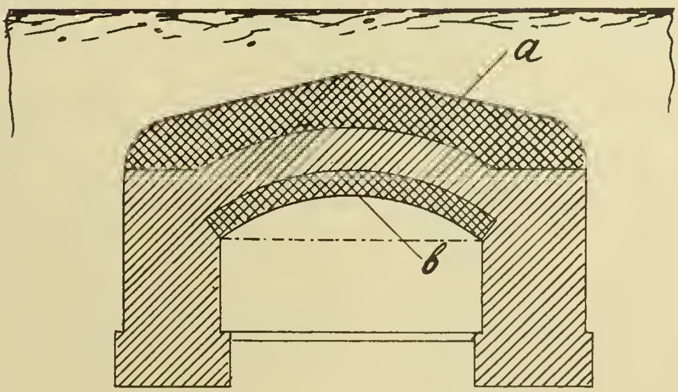


Fig. 3.



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BY Richards & Geier
ATTORNEYS

Published May 4, 1943 Serial No. 257,240

ALIEN PROPERTY CUSTODIAN

PROCESS OF SEPARATING ALBUMINOUS PRODUCTS FROM MILK GOOD FOR BEATING AND BAKING

Karl Kremers, Stuttgart, Germany; vested in the Alien Property Custodian

No Drawing. Application filed February 18, 1939

There are different processes of producing albumin from milk. For instance albumin is precipitated by employing heat and chemicals. But in this well known process albumin is considerably reduced in value as it is won by precipitation in irreversible state (may be under the influence of heat or by chemical reaction) which means loss of those qualities of albumin which are good for beating and baking. By this that albumin is limited in use and is for instance not good for baking.

This invention leads to a process which separates albumin contents from milk in such a state that an albuminous product is resulting which is good for beating and baking. For this purpose pH-value of the albuminous contents of milk is elevated up to more than 7 and then water of solution treated in this manner is removed at a temperature that prevents any detrimental influence of heat on colloids of albumin. Grade of temperature depends in a certain way of concentration of albumin and of the special kind of albumin or proteins and may be ascertained at any case. Generally, temperature is beneath 60°C.

This process may be employed either by separating albumin from whey or casein from skim milk. An albuminous product of excellent qualities for beating and baking is obtained from a mixture of skim milk with whey.

Water of solution may be removed either by separators or by evaporating if the points of view mentioned above are taken in consideration.

The practical execution of the process is described in the following.

In order to obtain an albuminous product from whey, first this whey is cleaned by removing slime. Then pH value is raised to more than 7 by adding alkaline materials, without heating up, at low temperature. By this, albumin of whey is changed over to particles which are good for beating and baking. This process may be assisted by simultaneous influence of electric current giving an opalescent muddy of albumin in medium of dispersion. Product treated in the described manner is removed from medium of dispersion up to the desired dry content at a temperature which prevents any detrimental influence on colloids.

Concentration of albumin by separating solvent may be done advantageously in separators. Time of reaction should be fixed in a way that removing of water up to a dry content of 6–12% and the following drying process for instance in a spray-drying-chamber are finished before muddy of albumin, obtained by changing pH, begins to redissolve.

Example I

Purified whey in a continuous flow of liquid gets into an arrangement in which ammonia in gaseous form is supplied in a quantity which is in proportion to the quantity of whey running through. Quantity of supplied ammonia has to give an increase of pH value over 7. At the same time or before or after this, an electric current, preferably alternating current, takes influence on medium of dispersion. Medium of dispersion is leaving arrangement with character of an opalescent muddy which represents a reversible precipitation as it disappears by returning to the original pH value.

It is proven as a fact that the wellknown methods of settling and filtration refuse. Settling the opalescent liquid albumin is in contact with medium of dispersion for a too long time. On account of its reversible character the opalescent muddy may return to the original state of solution. By filtration of the opalescent muddy pressure will denature colloid of albumin.

In contrary to this these disadvantages are avoided by concentrating albumin with separators.

I have found it best to concentrate liquid up to 6–12% dry content and that higher concentrating will denature albumin by pressure. According to this described example opalescent albumin muddy runs into a nozzle separator and leaves it for instance with a concentration of about 8% dry contents.

In order to dry this liquid, spray-drying-chambers have proven best. Drying in contact-drying chambers is detrimental to a certain degree for albumin. Therefore concentrated albumin coming out of the separator runs into a spray-drying-chamber in which water is totally removed from albumin.

In order to obtain a large gain of dry substance with this method, it is possible to raise quantity of concentrated liquid, which contains the opalescent albumin muddy, at the cost of cleared liquid leaving the separator in such a way that a part of the non-proteins and a part of the rest-proteins being in solution get into the dry substance. By this, not only the quantity of the separated dry substance will increase but also a product is obtained which is better for several purposes than pure albumin for instance on account of its content of sugar. This product

is just as good for beating as pure albumin. Special separators are used for this purpose which may be regulated in such a manner that desired purity of product is obtained. If for instance with method described first 1000 ltrs of whey give 800 ltrs cleared liquid and 200 ltrs concentrated albumin, on the second way 1000 ltrs of whey give 500 ltrs cleared liquid and 500 ltrs concentrated liquid. After drying, 35 kg dry albumin-product result from concentrated liquid which have got besides albumin also milk sugar, milk salts and some other materials.

Instead of separating albumin with separators it is also possible to separate it from solvent by drying it together with all the rest of the solid contents. As mentioned above this drying should be done at a temperature which excludes detrimental influence of heat on colloids of albumin. Working with this method, first pH value of whey is elevated with a suitable alkali and then, treated in this way, is concentrated by vacuum vaporisation. Finally concentrated albumin liquid is dried in a spray-drying-chamber.

In this way it is possible also to get a product good for beating and baking with sufficient albumin content. Of course I can reduce percentage of milk salts and milk sugars removing milk sugar from whey before or after concentrating for instance by fermenting or crystallisation.

In both of the cases of protein separation mentioned last protein content of the product made of whey may be raised by adding soluble casein or white of egg or both. It has been proven especially suitable to add alkali-casein or soluble casein containing calcium or both of these materials or also in connexion with materials containing proteins which may improve qualities of products good for beating and baking and may improve stability of albumin foam. Instead of employing alkali, pH value of medium of dispersion may be raised by adding some lime base which may be taken instead of alkali or with alkali. It has proven especially suitable to add calcium hydroxide. Adding these materials, the whole protein of the milk changes over in a product which is good for beating and baking. This method may be used as well for albumin as for casein, also for precipitated milk proteins, acid curds, rennet curds and also with those milk proteins which are still in natural state of colloidal solution.

In order to work with this method for instance milk is creamed and casein of skim milk is precipitated as curds. pH-value of casein precipitation partly leased from whey is raised up by the influence of lime base, especially of calcium hydroxide until pH of the originating colloidal solution passes over 7. Simultaneous with calcium hydroxide a volatile alcali may be used. Now milk serum from casein precipitation is treated in the same away after being concentrated by vaporisation at a temperature which prevents any detrimental influence of heat on colloids of albumin. Both solutions obtained in the described manner are mixed then in a fit proportion and dried in a drying-chamber. It is also possible to elevate pH value in a way that first a dry mixture of milk proteins and lime base is made and then water is added to bring both materials in solution and on the desired pH.

Concentrating whey in a vacuum dryer it is necessary to take care of a high vacuum in order to obtain slow temperatures. The dryer should be absolut clean as rests of other materials reduce qualities of albumin which are good for beating and baking. Therefore albuminous milk serum and for instance creamed milk cannot be concentrated alternately in the same dryer. But it is possible to concentrate whey and skim milk at the same time in a common solution. The remaining dry substance is good for beating and baking. This method is especially simple and economical and gives a very good gain.

You may do this in different way. For instance it is possible first to raise pH only of whey and then mix it with skim milk or mix first whey with skim milk, raise the pH and finely evaporate.

Example II

pH of 5000 ltrs of cleaned whey is first fixed somewhat over 7 with calcium hydroxide. After this 5000 ltrs of skim milk are added. This solution of 10.000 ltrs is concentrated in a vacuum dryer. Then calcium hydroxide is added until pH value goes up to 10. Solution obtained in this way is dried in a spray-drying-chamber. Before entering the atomiser solution may be heated up to a degree of heat which is somewhat over temperature of atomiser.

It has been found that pH of obtained dry substance is somewhat below pH of solution and fluctuates in a certain degree. This fluctuation depends of temperature of process and also of reaction time in state of solution. As on the other side pH of 9–10 is desirable in order to get a product with best qualities for beating it is necessary to fix pH of solution on 10 in order to let it slide up to 9.

Composition of this solution may be changed relative to proportion of quantity of its two parts. As albumin is of higher value than casein it is desirable to raise percentage of whey of common solution.

KARL KREMERS.

Published May 4, 1943

Serial No. 261,133

ALIEN PROPERTY CUSTODIAN

PROCESS FOR OBTAINING CELLULOSE FROM RESINOUS PINE WOODS

Francesco Carlo Palazzo, Firenze, Italy; vested in the Alien Property Custodian

No Drawing. Application filed March 10, 1939

As is known the maximum part of the wood cellulose is produced chiefly in view of being utilised in the rayon industry, by the calcium bisulphite process, but the extension of this industry hitherto has been affected by a limiting factor, namely the availability of coniferous timbers poor in resins such as those of the various species of fir, since the application of that process, even in its more modern forms, has hitherto remained circumscribed to such woods, without being able to extend to all the various species of pines. In particular the red fir or Scotch pine (*pinus silvestris*) which is so widely diffused in central and northern Europe and the cluster pine or pinaster (*pinus pinaster*), which forms extensive forests, chiefly in France, in the Department of the Landes, have not been able to make the slightest contribution particularly to the rayon industry, since the latter requires bisulphite cellulose, whereas from the pines indicated above the cellulose has hitherto been produced exclusively by the soda method or by the sulphate method, being obtained with characteristics that do not satisfy the requirements of the rayon industry.

Nevertheless, from a systematic series of experiments which have led to the present invention, it has clearly emerged that the difficulties hitherto encountered in boiling resinous pines in the bisulphite process are not to be attributed to a different nature of the lignine, but to circumstances that have apparently nothing to do with the suitability of the bisulphite lye for decrusting their cellulose fibres.

Moreover the presence in the woods of the various species of pines of a quantity of resin noticeably greater than in the woods of the firs is not the sole reason for the difficulties hitherto encountered in boiling the woods of the pines with bisulphite. Evidently this accentuates a difficulty which is also present even in some broad-leafed woods, namely the difficulty constituted by the great compactness or solidity of the ligneous tissue. But in addition to this when the percentage of resin in the coniferous woods exceeds a certain limit, the cellulose, which can best be extracted from them by the bisulphite process, gives rise, during the subsequent working thereof, to notable discharges, to such an extent that in the case of pines the industry has ended by completely abandoning all bisulphite boiling. Starting from these considerations the experiments that have led to the present invention have had a triple purpose in view:

(1) The preliminary elimination of a large part of the resin by means of a weak alkaline treatment of the wood, preceding the bisulphite boiling;

(2) The impregnation of the wood thus treated, with a bisulphite lye which is capable, by its penetrating power, of completely impregnating the ligneous tissue, and which is also capable, by its composition, of decrusting the lignified cellulose fibres, even at relatively low temperatures, for instance at temperatures below 110° C.;

(3) The diminishing of the percentage of resin in the cellulose by means of a weak alkaline treatment, which is applied thereto before preparing it in sheets.

The physical and chemical characteristics of the products obtained according to the invention from the woods of various species of resinous pines (*pinus pinaster Sol.*, *pinus pinea L.*, *pinus nigra* Arn., with its sub-species *pinus silvestris L.*, *pinus insignis Dougl.*, *pinus strobus L.*, and the like) show in a tangible manner that the object in view has been fully attained as soon as the products themselves by their title of alpha-cellulose (90 to 93 per cent.), by their resin content (from 0.2 to 0.4%) and by their ash content (from 0.15 to 0.20%), by their copper number (less than 2), by the high grade of bleaching, and by the viscosity being somewhat greater than the ordinary values, perfectly fulfill all the most rigorous demands of the artificial textile industry. Therefore while the process described below justly claims the prerogative of boiling, with a lye having a basis of calcium bisulphite and of sulphurous acid, the resinous woods hitherto regarded as being incapable of being treated by the normal bisulphite process, the same remains typically marked by the above-mentioned characteristics, which, extending to new species of conifers the application of bisulphite boiling, will from this time forth provide a use to a higher degree of extensive pine forests, and will supply, chiefly the rayon industry, with a new and copious source of cellulose of the best quality.

It should moreover be expressly remarked that the process according to the invention, although being particularly worked out for the treatment of resinous pines, is applicable in a most general manner to the boiling of the most varied cellulosic materials, having regard to the fact that the perfect impregnation of the latter with the bisulphite lye, and the particular composition of this lye, render possible the decrusting of the lignified cellulose fibres even at temperatures below 110° C., with the advantage of appreciable saving of sulphur and fuel. In the case of non-resinous

woods, the alkaline treatment interposed between the two bleaching operations may be executed at a lower temperature, for instance between 50 and 60° C., and with a liquor containing 0.2 per cent. of sodium carbonate.

The industrial application of the new process does not present any difficulty in practice, since any installation for bisulphite boiling is capable of applying the process without any change having to be made in its normal equipment. This applies not merely to the digesters, the maximum working pressure of which will likewise be from 6 to 7 atmospheres, but also to the preliminary preparation of the wood, and to the manufacture of the bisulphite lye, as well as to all the mechanical and chemical operations subsequent to the boiling.

Before introducing the bisulphite liquor into the boiler charged with wood, the latter is subjected to a preliminary treatment in the open boiler, at temperatures of from 90 to 95° C. and for a duration of from 1 to 2 hours, with an alkaline liquor containing from 0.1 to 0.2 per cent. of sodium hydrate, employed as usual in the preparation of from 4 to 5 volumes to 1 p. by weight of wood. The alkaline lye having been discharged, and a summary washing having been given to the wood in the boiler itself, the bisulphite liquor is introduced, after previously having been adjusted in its composition in such a manner that after mixing with the water absorbed by the wood, there finally results a liquor containing from 0.5 to 1 per cent. of calcium oxide and from 5 to 6 per cent. of sulphurous anhydride, free and semi-free. The boiling is then initiated by heating indirectly with steam to a temperature of from 106 to 108° C., and this temperature is then maintained constant for the whole duration of the boiling, while the pressure also remains constant at from 6 to 7 atmospheres, assuming that in the course of the boiling there does not occur at any time the slightest leakage of sulphurous anhydride.

At the end of this boiling the pressure is discharged by the known methods, which involve the recovery of the sulphurous anhydride, and the coarse product is washed several times in the boiler itself with hot water, and is then subjected to the customary mechanical treatments, which reduce it to a paste ready for bleaching.

The degree of decrustation which is attained in the boiling described above, when a suitable duration, which varies from 12 to 20 hours according to the wood treated, is given to the latter, is such that the crude product can be bleached by employing moderate quantities of chlorine, amounting to no more than from 4 to 5 per cent. of the bleached product. It is however not necessary to have recourse, before the bleaching, to chlorination with gaseous chlorine or with chlorine water, but the crude product may be treated directly with the bleaching liquor having a base of hypo-chlorites. A lye which has been found particularly active in every case is one which, without being acidified by strong mineral acids, contains about one half of hypochlorous acid in a free state, and the remaining half as a calcium or sodium salt. Within 5 to 6 hours, even at an ordinary temperature, the bleaching is almost complete. The cellulose is then washed abundantly with water, after which to the mass circulating in the vat is added sufficient sodium hydrate to form a liquor containing from 0.2 to 0.3 per cent. thereof. The temperature of the mass is carried to about 90° C., and the mass is caused to circulate for 1 or 2 hours, after which it is thoroughly washed, and finally subjected to a fresh bleaching of short duration, for instance 1 to 2 hours, with a bleaching liquor of the same composition as has been indicated above. It is again washed, and the last traces of hypo-chlorous acid are decomposed with a solution of sulphurous anhydride, which likewise has the effect of diminishing the percentage of ash. After a fresh thorough washing the cellulose is finally ready to be prepared in sheets.

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ALIEN PROPERTY CUSTODIAN

PLASTIC MATERIALS AND THE MANUFACTURING PROCESS OF SAME

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No Drawing. Application filed March 10, 1939

The present invention concerns a sheet shaped plastic material and its manufacturing process, for which are used the various paper pulps, which are wanted to be mixed with substances, which in contact with water, become gelatinous, the association of the two materials making the new one constituting the object of the invention.

It is known that in the paper and pasteboard industries, it is not possible to use, in a large proportion in order to give new properties to the manufactured products, the substances which together with water are making a jelly, owing to the fact of same would retain too much water, render draining impossible in a machine and obturate the wire gauze.

This invention has for its object to eliminate the above mentioned difficulties and to allow the use, at the ambient temperature, of mannane or similar substances. The resulting product is flexible, quite strong against wear, tear and traction, and capable of a large utilisation for industrial purposes. The invention is characterised, in the principle, by the insolubilisation of the mannane, prior to the use in the paper making machines, and in the reduction of same into a meal before or after the said insolubilisation.

Such an insolubilisation is got by means of any known agent: bases, carbonates, lead salts, basic copper, etc.

As a non-limitative example may be mentioned the following process:

First example

1. One hundredweight meal of mannane, in a tight recipient, is exposed during a few hours to the ammoniacal gas.

2. After the treatment with ammoniac, the product is conveniently ventilated so as to remove any non-combinated part.

3. Battery working. Within a battery containing the wanted volume of water for mixing and refining, are introduced:

Paste of various cellulose	cwt	1
Meal of insolubilised mannane	cwt	1
Meal of soluble mannane	lbs	56

The soluble mannane is aggregated in order to make easier the binding between the insoluble mannane and the paste.

4. The whole is duly refined and diluted in the tub, and forwarded to the machine, round form or flat table as usually.

Second example

1. Two hundredweight meal of mannane are baked in a water bath (during the required time, its insolubility being indicated by taking off a sample) including:

2. 45 lbs. potassium or sodium carbonate.

3. Water to which is added a miscible liquid in the wanted quantity for dissolving the carbonate and covering the product.

4. After baking, the whole is washed within the centrifugal drying machine and mixed, as above said, in the battery, etc.

For working the 2nd example, every precipitation or jellification agent of the pseudosolutions of mannane can be used into solution in the water instead of the miscible liquid such as, for instance, alcohol, acetone, etc. The product thus obtained into sheets or otherly shaped are dried either by a press, a centrifugal machine or any other suitable means, and kept during a certain time in a gelatinising bath for the insolubilised mannane, such as:

Water acidulated, glycerined, formoled or similar.

The wanted product is obtained after drying.

The above indications are given only as examples, and the details of realisation and working may be variated in each application without departing from the principle of the invention.

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ALIEN PROPERTY CUSTODIAN

METHOD OF AND APPARATUS FOR THE CONTINUOUS PRODUCTION OF PHOTO-PRINTS

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Application filed April 17, 1939

This invention relates to a method of and apparatus for the continuous production of photoprints involving the use of printing paper which is automatically passed first together with an original through an exposing device and then by itself through a developing device.

This method of working has hitherto been practised by placing originals on webs of printing paper taken from rolls of standard commercial breadth, in no particular order but so as to utilise as well as may be the total breadth of the web, then passing the web of printing paper with the originals in contact therewith through an exposing device, removing the originals by hand, passing the web of exposed printing paper by itself through a developing device, developing and if necessary drying the web, roughly cutting the prints out of the web, and finally trimming the individual finished prints.

The known method is laborious and wasteful. To begin with, the placing of the originals on the printing paper web is attended with difficulties. In order to utilise to good advantage not only the breadth but the entire superficial area of the standard rolled photoprint paper, it is generally necessary to place two or more originals side by side. Since, however, the paper web is continuously in motion, it is generally not possible to place the originals in favourable positions. The result is that free spaces are left on all sides between the originals with additional substantial gaps that remain uncovered, so that considerable wastage of paper occurs.

Since the number of prints comprised in any one printing order must be delivered together with the original it is necessary, with the hitherto known method of working, to sort the prints after the printing work proper has been done, and this sorting operation is tedious and wasteful of time. It is found in practise that the amount of time and trouble required for such incidental work is greater than that involved in the actual printing work. A further disadvantage of the known method is that large quantities of waste printing paper accumulate in the work-rooms.

All these drawbacks are obviated by the present invention, according to which the photoprint paper used is of a breadth equal to one of the main dimensions of the finished prints and is brought into accurate register with the originals prior to being fed into the exposing device, with the aid of guide marks provided for this purpose on the paper and spaced to correspond to the other dimension of the originals, after which on emergence from the exposing device the originals are consecutively detached from the printing paper, collected and stacked in their original order.

When rolls of photoprint paper are used the invention is put into practise by providing the paper web with printed-on, stuck-on, or punched-out guide marks to act as guides in positioning the originals consecutively on the travelling paper web, so that after developing, and without interruption of its movement, the paper web may be fed to a mechanically operated transverse cutter by means of which the individual prints are severed from the web and likewise mechanically collected and stacked in their original order.

The operation of the transverse cutter may be controlled by an adjustable member associated with the driving gear of the photoprinting machine and adapted to respond periodically, in accordance with the length of the individual prints, so as to effect the operation of the transverse cutter for severing the prints. This control member may for example be a cam connected with a roller or pulley, the periphery of the roller bearing against and driven by the paper web having a circumference corresponding to the length of a single print. The arrangement may also be such that the guide marks themselves serve as members for controlling the transverse cutter and thus fulfill a double function. The machine may be operated either electrically or mechanically.

When sheets of photoprint paper are used, the guide marks are provided on a distributing table which may if desired be transparent, and the procedure in this case is to insert a sheet of printing paper corresponding in size to the total area of the originals to be reproduced in one operation mechanically beneath the originals, the latter being preferably placed with their rear edge touching the gauging or guide marks on the distributing table. The printing paper and originals are then fed jointly into the exposing device.

A particularly important advantage of the new method is that it enables prints to be turned out in large quantities with the smallest consumption of paper that is technically achievable. For this reason the invention requires that the breadth of the printing paper used shall be equal to the breadth or height i. e. to one of the main dimensions, of the finished prints. This eliminates the possibility of any waste in respect of the one dimension of the prints. Further, the originals are not placed in position on the print-

ing paper by eye, but with the aid of gauging or guide marks ensuring accuracy of positioning, so that the total wastage of printing paper is limited to intermediate strips corresponding to the margins of the originals, while when sheets of printing paper are used there need be no wastage at all.

The new method is also remarkable for the fact that it requires a minimum of work. The provision of guide marks enables the originals to be placed in position not only accurately but also very rapidly, and from the time the originals are placed in position onwards the machine works wholly automatically. To the rear of the exposing device in the direction of feed the originals become automatically detached from the printing paper and are stacked in precisely the same order as they entered the machine; the finished prints are also stacked in the same order as the originals. It is therefore not necessary to search about for the prints when gathering them together, since after the printing work proper there are obtained a number of stacks of finished prints and a stack of originals, and in all these stacks the sheets are arranged in the same order.

Two constructional examples of photoprinting machines in accordance with the invention are shown in the accompanying drawings, in which:

Fig. 1 shows a length of printing paper unwound from a roll and provided with different types of gauging or guide marks,

Fig. 2 shows in side elevation and partly in section a photoprinting machine provided with a cutting device,

Fig. 3 is a plan view of the rear end of the machine comprising the cutting device,

Fig. 4 shows an embodiment of the transverse cutter as seen from the rear end of the machine,

Fig. 5 shows the gearing between the member and the transverse cutter, together with an automatic disengageable clutch,

Fig. 6 shows, in section, taken on the line VI—VI of Fig. 5, the driving mechanism of a clamping bar disposed in front of the transverse cutter for holding the paper web fast during the cutting operation,

Fig. 7 shows a modified form of the transverse cutter,

Fig. 8 shows in cross-section a fragment of a printing paper web to which a metal contact is attached,

Fig. 9 shows in transverse section a photoprinting machine taking sheets of printing paper,

Fig. 10 is a partial side elevation, and

Fig. 11 a plan view of the paper table of this latter machine.

In the first form of construction shown in the drawings there is provided at one end of the printing machine a cupboard **1** containing a number of rolls **2** of photoprint paper. Above this cupboard there is a drawer or tray **3** for the originals **4** to be printed. One such original **4** is shown by way of example in broken lines in Fig. 1. This original has an all-round margin **4**a which is delimited on the inside by a chain-dotted line **4**c marking the limits of the actual area **4**b covered by the drawing. The web **11** of photoprinting paper is of a breadth corresponding either to the breadth or to the height of the actual area **4**b of the original drawing. The paper web is also provided at its edge with guide marks which may take the form for instance of punched holes **11**a and **11**b or of printed lines **11**c. The original drawings are then placed one after the other on the printing paper web **11**, for instance in the manner indicated in Fig. 1, so that the front border line **4**c exactly registers with the rear edge of the mark **11**b, while the lateral border lines **4**c exactly register with the longitudinal edges of the paper web **11**. The rear border line **4**c is then bound to register with the front edge of one of the marks **11**a.

The web **11** of paper to be exposed travels first over a roller **5** at the back of the drawer **3**, then over a roller **6**, whence it travels over a table **7** provided especially for the purpose of placing the originals in position on the paper and formed if desired by the top of the above-mentioned cupboard, to an exposing device **8** which may be of any convenient design. In the example shown a lamp **9** is suspended over a transparent member **10** having the form of a segment of a cylinder, beneath which the paper web **11** is passed by being conveyed on an endless carrier cloth **12**. The originals **4** from which prints are to be made are conveyed through the device by the paper web **11**. The table **7** must be at least as large as the originals **4** to be printed.

To the rear of the exposing device in the direction of movement of the paper web the originals **4** are automatically detached from the paper web and caused to drop, in their original order, into a collecting tray **13** in which they are stacked, while the exposed paper web **11** travels on downwards at a steep pitch over rollers **5**′, **5**″ mounted in a framework **14**, to a developing device **15**. In the drawing there is shown a small bath **16** for a developer liquid as used in the so-called semi-wet method. It is equally possible to employ the wet or the dry developing and fixing method. The wet method may also be employed in connection with a dry type photoprinting machine.

Behind the framework **14** is placed a cutting table **17** over which the developed paper web **11** travels.

At the rear end of this table is provided gearing **18** and beneath the table a driving motor for the operation, through the intermediary of this gearing, of a transverse cutter **29** for severing the individual prints **11**′ which then drop into a box **20** where they are collected and stacked in their original order. Beneath the cutting mechanism is provided a box **21** to catch the waste from the cutting operation.

The controlling of the cutter is effected in the example shown, by the guide marks **11**a and **11**b on the paper web **11**. For this purpose there is provided on the table **17** beneath the paper web **11** a fixed counter-sunk contact **22**, and above the paper web **11** a contact spring **23**. These contacts are spaced in advance of the transverse cutter by a distance approximately equal to the length of a print. Each time a guide mark **11**a or **11**b passes between the contacts **22** and **23** a current circuit is closed whereby the cutter **29** is switched on either directly or through the intermediary of a relay. Fig. 3 illustrates the moment at which, owing to circuit closure by the guide mark denoted by **11**a in the drawing, the cutter **29** is being operated to cut the paper web through in a transverse direction. When the paper web has travelled through the distance a in the direction indicated by the arrow, the guide mark **14**b situated to the left of the guide mark **14**a again closes the operating current circuit, with the result that a second cut is made which separates from the paper web a waste strip of the breadth a corresponding to the sum of the breadths of the two margins **4**a of two consecutive original draw-

ings 4 and comprising the two marks 11a and 11b.

In order to cut prints of other lengths, further contacts 22, 23 must be provided in the machine at suitable distances from the cutter 29, and the pairs of contacts not in use at any one time be rendered inoperative, for instance by lifting the respective contact springs 23. The motor 19 runs continuously and drives a shaft 27 by means of a cord or belt 26. On this shaft 27 there is provided a clutch the engaging member 28 of which (Fig. 5) is adapted to carry out a single revolution at a time and then to come to a standstill.

In the severing arrangement shown in Figs. 2, 3, 4 and 5 a two-armed shearing cutter 29 is pivoted on a pin 30. A spring 31 presses against the shorter arm 32 of the two-armed cutter 29 and tends to retain the cutter in its position of rest over the path of the paper web. A cam disc 33 on the clutch member 28 forces the cutter 29 downwards against the spring 31, as it rotates, and thereby operates the cutter.

The cam disc 33 is integral with the clutch member 28 mounted idly on the shaft 27. Fast on the shaft 27 is the other clutch member 34 having in its interior an electro-magnet 35. In the clutch member 28 is inserted a spring-loaded coupling pin 36 which, in the position of rest of the clutch, is retained in the position shown in Fig. 5 by a wedge member 37 fixed to the framework of the machine. The pin 36 is capable of engaging in a number of apertures 38 in the clutch member 34, and that in the following manner: As soon as the magnet 35 is excited by a current impulse it attracts the coupling member 28. The hook-shaped cranked outer end of the coupling pin 36 then slides clear of the wedge-shaped member 37 and the pin 36 drops into engagement with the nearest aperture 38. The clutch members 28 and 34 then remain interengaged, independently of the duration of the short current impulse effecting the interengagement, until, after a complete revolution, the pin 36 is withdrawn again from the aperture 38 by the action of the wedge-shaped member 37.

In order to ensure that the clutch comes to a standstill after exactly one revolution there is mounted in the revolving clutch member 28 a bell-crank lever 39 one arm of which strikes against a stop 40 secured in the framework of the machine as soon as the coupling pin 36 is lifted. To enable the clutch to start rotating again the other arm of the bell-crank lever 39 takes the form of an armature which, on excitation of the magnet 35, is attracted and thereby removes the projecting arm of the bell-crank lever 39 from the stop 40. As soon as the current impulse ceases the bell-crank lever 39 returns into the arresting position in response to a spring 41.

Adjacent to the cutter 29 there is provided a clamping bar 42 (see Figs. 2, 5 and 6). This clamping bar is depressed by synchronized eccentrics 44, through the intermediary of telescopic interengaging rods 43, as soon as the clutch is engaged. The clamping bar 42 is caused to bear against the paper web 11 shortly before the cutting operation and remains bearing against the paper web, owing to the pressure exerted by springs 45, holding the paper web fast, until the cutting operation has been performed. One of the eccentrics is supported on the clutch member 28.

In the modified form of construction of the transverse cutter shown in Fig. 7 a shearing blade 46 is guided relatively to the paper web 11 by means of pins 47 and inclined slots 48. The advantage of this arrangement over that employing a pivoted cutter 29 consists in obtaining a drawing cut. In this case the clutch member 28 is connected to the cutter 46 by means of a thrust rod 49.

Instead of causing a cutter to cut twice in rapid succession it is also possible to use a double-blade cutter for the purpose of cutting out the waste strip *a*. In this case it is sufficient to provide one controlling guide mark 14a for each print, as shown in the middle portion of Fig. 1. It is likewise only necessary to close the current circuit once for each cut if the prints are to be delivered with a margin, i. e. untrimmed; the prints are then cut along the lines at which the originals touched each other.

As shown in Fig. 8, the guide marks may consist of metallic contacts 50 clamped to the edge of the paper web 11. Any other mode of establishing contact may be employed which is suitable for starting the operation of the cutter. Controlling with the aid of guide marks need not necessarily be electric.

If the marks merely serve for positioning the originals on the printing paper while the automatic cutting of the prints from the paper web is effected otherwise than in direct dependence on the guide marks then these marks need merely be any visible marks 11c produced by printing or impression, as shown in the left-hand part of Fig. 1, provided they are capable of serving as guides in positioning the edges of the originals.

In order to obtain prints of a size different from that determined by the guide marks (contacts) provided on the paper web, there may be mounted, above the table 7, as at the point A, a small hand punching device or press with the aid of which fresh marks (contacts) may be produced on or attached to the paper web 11.

Referring to Figs. 9 to 11, 1a denotes the framework of the photoprinting machine, 3a the drawer which in this case serves to hold cut sheets 2a of printing paper, 4 an original drawing, 7a the distributing or paper table, 8 the printing or exposing device, 9 the electric lamp, 10 the transparent cylindrical segment, 12 the endless conveyor cloth, 13 the tray for the original drawings, 14 the supporting framework for the developing apparatus 15, and 20 the collecting tray for the prints 2a. The detaching of the originals 4 from the sheets 2a of printing paper at or near the rear guide roller 12a for the endless conveyor cloth may be effected mechanically by means of a wedge-shaped member 12b, or by any other suitable means, for instance pneumatically.

The distributing table 7a which is preferably transparent and which may be illuminated from below, is provided with guide marks for the standard printing paper sheet sizes A_1, A_2, A_3, A_4; similar marks may also be provided for other sizes of prints. The positioning of an original is effected, for instance, in the case of size A_1, by placing the left-hand and right-hand rear corners of the marginal line 4c accurately against the marks denoted by A_1. The marks A_2 are used for size A_2, the four marks A_3 for a pair of originals of size A_3 to be positioned simultaneously, and the four marks A_4 for the simultaneous positioning of the two original drawings of size A_4. In two latter cases there are provided two drawers or a tray with two compartments for the reception of two stacks of prints 2a. The guide marks are so located that when the originals have been placed in position the leading

edge of the original extends beyond the summit of the front driving roller 12a of the conveyor cloth 12, which is disposed in the mid-plane D—D of one of the uprights of the framework. The positioned drawing 4 and the sheet of printing paper 2a of appropriate size inserted in the manner described below are pressed by an automatically controlled roller 51 against the conveyor cloth 12 travelling over the feed roller 12a, and kept pressed against this cloth until the two parts 4 and 2a have been reliably gripped and have begun to be fed into the exposing device.

The means for inserting the cut sheets 2a of printing paper beneath the original drawings 4, and for controlling the pressing-up roller 21 supported with vertical adjustability in the framework 1a of the machine, are as follows: 52 denotes solid rubber rollers mounted on a carrying rod 52a with a one-way free-wheeling clutch device, which rest upon the sheets of printing paper stacked in the tray 3a, and which are reciprocated between the end positions shown in Fig. 9 by means of connecting rods 53 and rocking levers 54. At each forward movement these rollers push a sheet of printing paper forwards, while on the return stroke they are free to rotate and consequently roll over the top sheet of paper without moving it. Four rubber feed rollers of this kind are provided corresponding to the number of sizes of sheets to be handled, and these rollers are adjustable on their carrying rods 52a. The rocking lever 54 is fulcrumed at 55 beneath a bracket 56 which also serves to support the tray 3a from which a ramp 57 serving to guide the forward edge of the sheet of printing paper leads up to the first conveyor roller 12a.

The rocking levers 54 are driven by means of connecting rods 58 connected to a wrist-pin 59 on a crank element attached to a shaft 60 supported in the framework 1a of the machine. The crank elements take the form of cam discs 61 and are adapted, through the intermediary of rollers and push-rods 62 guided in the framework of the machine, to control the pressing-up roller 51 which is likewise journalled in the framework of the machine.

The shaft 60 is connected by means of a belt 63 with the shaft of a driving pinion 64 pertaining to change a speed gear 66 which is controllable by means of a hand lever 65, and in which movement is initiated by a shaft 67. This shaft 67 is adapted to be brought, by means of a clutch 68, into and out of engagement with the main shaft 69, from which is taken the drive for the conveyor cloth 12 and two endless cloth belts 70 which convey the exposed prints to the developing device.

The operation of the described apparatus is as follows:

An original drawing, for instance of the standard size DIN A1, is placed in position against the guide marks A_1 on the table 7a, in which position the forward edge of the drawing extends in between the spaced rollers 12a and 51, and projects some 4 to 5 cm beyond the summit of the roller 12a. At the same time, by means of the rubber forwarding rollers 52 a sheet of photoprint paper of the same standard size as the original is fed in between the original and the contact roller until the forward edge of the sheet of printing paper registers with the forward trimming edge of the original drawing. In the course of the further operation of the machine the pressing-on roller 51 automatically descends and grips the original drawing and the sheet of printing paper between this roller and the guide roller 12, with the result that the original and the printing paper are jointly engaged and carried forward by the conveyor cloth 12. After the originals and the sheets of printing paper have travelled round the cylinder, the originals 4 are detached from the prints 2a by means of the wedge-shaped member 12b and deposited consecutively in the tray 13. The prints are fed by the conveyors 70 into the developing device 15 from which they are discharged and collected in sequence in a pile in the tray 20. As soon as an original and the sheet of printing paper have been engaged by the conveyor cloth 12 and have started to move, the pressing-on roll 51 is automatically lifted, after which the insertion of the next original and sheet of paper can be proceeded with.

In making prints from smaller originals of the sizes DIN A2 to DIN A4 the parts 51 and 52 must carry out their periodical movements derived from the shaft 69 at a more rapid rate, which is obtained by the appropriate setting of the change speed gear 66.

Instead of a developing device 15 for dry developing it is also possible to employ a device for semi-wet developing or for wet developing. When wet prints are produced a drying device may be built on, and in this case the stacking of the finished prints is effected when the prints are discharged from the drying device.

The stacked prints 21 are guided at the sides in the sliding tray 3a or in its compartments and bear with their rear edges against the end of this tray. Since the feed members 52 become lowered as the stack of sheets of printing paper becomes used up, and consequently carry out a progressively shorter stroke, it is advisable when using high stacks of printing paper to provide a quoin as indicated in dotted lines at 53, at the back of the sliding tray, for the purpose of inclining the rear end of the stack to a slope of such a pitch that the shortening of the stroke of the feed members 52 due to the reduction in the height of the stack is compensated for.

Instead of the described rollers 12a and 51 it is equally possible to employ any other type of conveying or advancing rollers.

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METHOD OF AND APPARATUS FOR THE CONTINUOUS PRODUCTION OF PHOTOPRINTS

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3 Sheets-Sheet 1

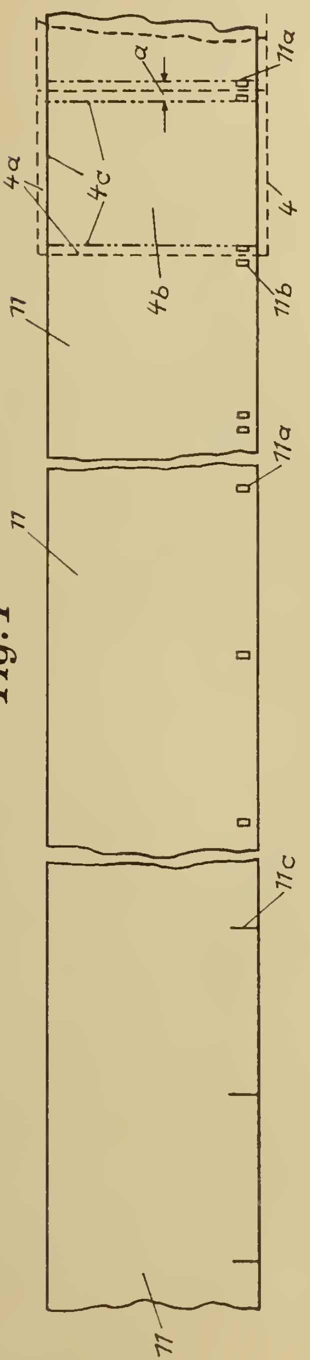

Fig. 1

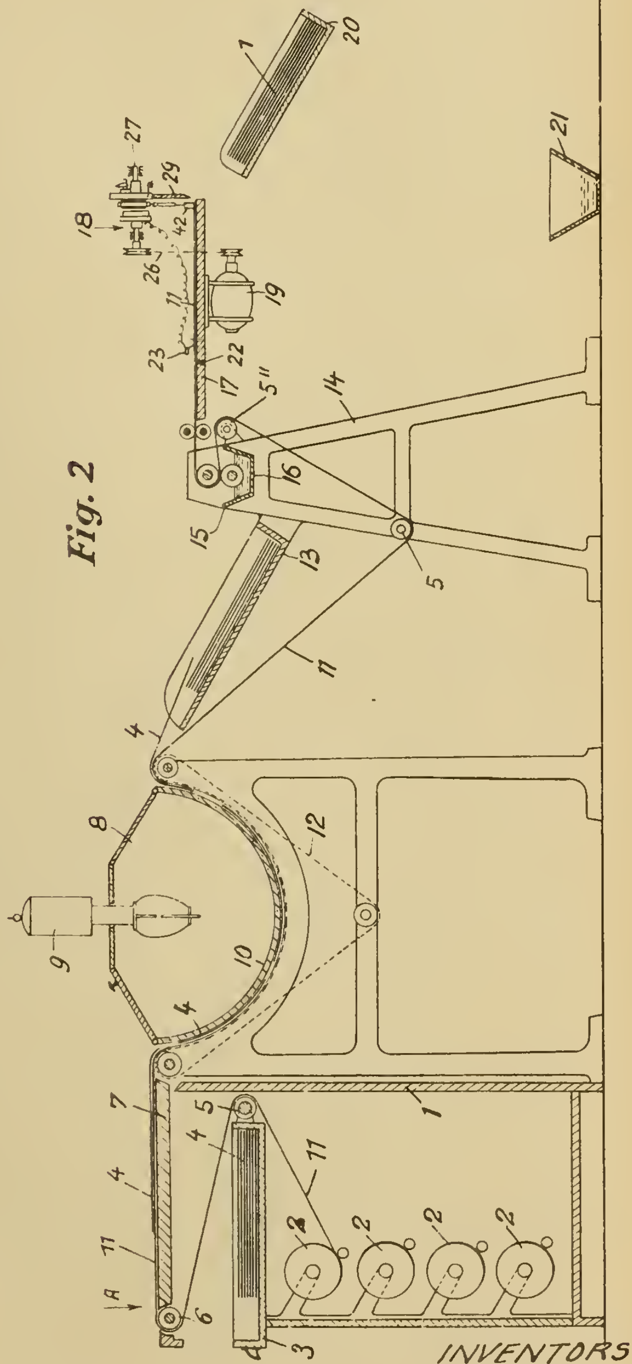

Fig. 2

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3 Sheets-Sheet 2

Fig. 3

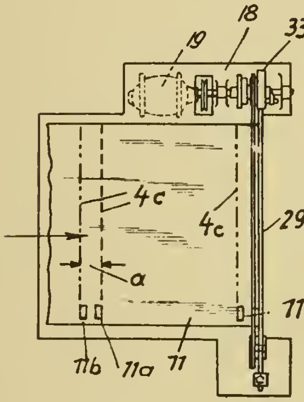


Fig. 4

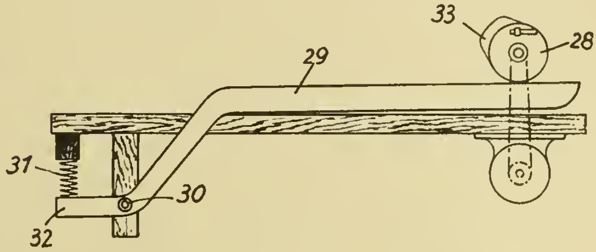


Fig. 7

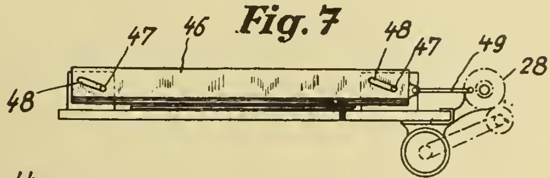


Fig. 5

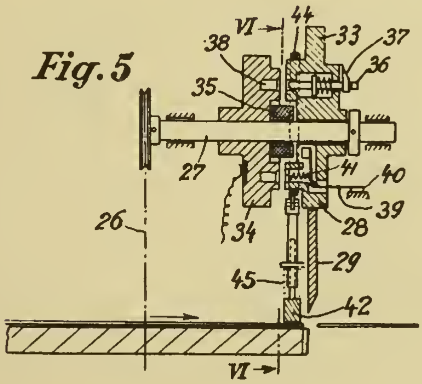


Fig. 8

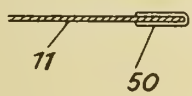
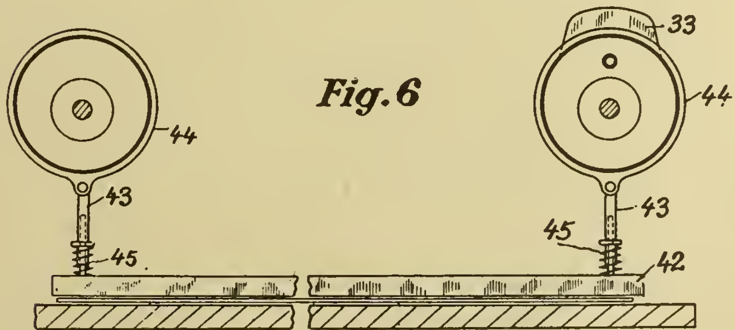


Fig. 6



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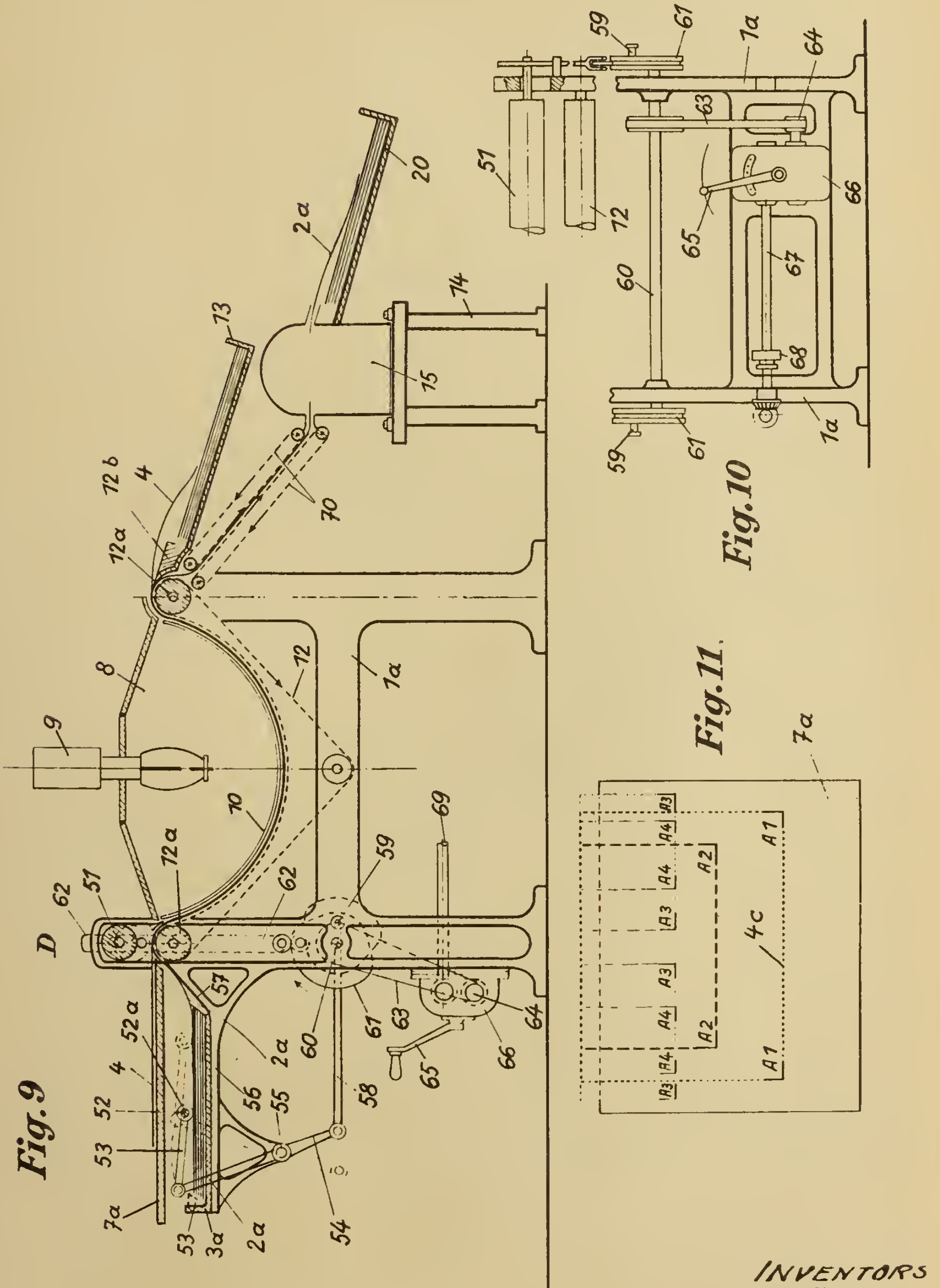
3 Sheets-Sheet 3



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ALIEN PROPERTY CUSTODIAN

VOLUMETRIC LIQUID METERS

Henri Boutillon, Suresnes, France; vested in the Alien Property Custodian

Application filed April 18, 1939

The present invention relates to volumetric meters employed for the measurement of volumes of liquid at a high output.

Hitherto, use has been made of meters whose size corresponds to the output of liquid traversing the apparatus. A meter of large size cannot be employed for the measurement of small outputs, as it would be too expensive for such work, while on the other hand it would be inaccurate if it operated at an output much below its normal output. For this reason, it is customary to construct a series of meters in increasing sizes in order to correspond to the needs of the industries. The result is a considerable outlay for models and an expensive manufacture, owing to the construction of large models in reduced number.

Moreover, the gas or air separator, which is usually indispensable, must also be provided in several models of corresponding size. As a rule. the unit consisting of the combined meter and separator must be specially designed and realized in each case, the two apparatus being connected together by piping whose arrangement depends upon local conditions.

The present invention has for its object to provide a volumetric meter for liquids which is of an economical construction and is characterized by the fact that it consists of the juxtaposition, in sufficient number to obtain the necessary output, of units each of which forms a volumetric meter having a reduced output and complete in itself, said units being so arranged that they may be readily connected and that they operate in parallel upon the same piping.

Further characteristics of the said meter, as well as various details of construction of the unit meters, will be set forth in the following description.

The invention also consists of said unit meters considered in themselves.

In the accompanying drawings, which are given solely by way of example:

Fig. 1 is a side view, partly in section, of a meter consisting of five sections or unit meters.

Fig. 2 is a corresponding elevational view.

Fig. 3 is a vertical longitudinal section, on a larger scale, of two consecutive units.

Fig. 4 is a cross-section on the line 4—4 of Fig. 3.

Fig. 5 is a vertical section, on a larger scale, of the aggregate of movable parts of a unit, which group is supposed to have been removed from the said unit.

Fig. 6 is a detail view of the actuating mechanism for a controlling slide-valve.

Fig. 7 is a sectional elevation of a modification of the slide-valve and its actuating parts.

Fig. 8 is a partial vertical section on the line 8—8 of Fig. 7.

Fig. 9 is a plan view of the slide-valve shown in Fig. 7 and of the fixed orifices which it successively opens and closes during its movement.

In the embodiment shown in Figs. 1 to 6, and as represented in Fig. 2, the meter consists of the identical units A, B, C, D, etc. assembled in number proportional to the desired output. Each unit comprises not only the measuring device, but also its accessories, such as the admission and discharge pipes, as well as the separator of the air and gas contained in the liquid, and all of such accessories are designed as sections having the same length as the measuring unit, and are assembled in junction planes XX, YY, etc. which are perpendicular to the longitudinal axis of the apparatus.

Each unit is preferably constructed as follows (Figs. 3 and 4). A main body 1 comprises four horizontal cylinders 2 mounted in two parallel pairs, each pair having two oppositely-situated coaxial cylinders. Each cylinder is preferably provided with a lining which is coated internally with an electrolytic deposit of polished chromium, in order to reduce the friction and the resulting wear to a minimum, and also to eliminate the risk of corrosion. Each cylinder contains a slidable piston 3 which is preferably provided with a plastic packing 4 of leather, natural or synthetic rubber, or any other substance suitable for the liquid in use. It will be understood that the said pistons can consist entirely of metal, and may be provided with metal piston rings, without departing from the principle of the invention. The two pistons of each pair of oppositely-situated cylinders are connected together by two rods 5 and 6 which are slidable in fixed guiding sleeves 7 and 8 for the rod 5, and 9 and 10 for the rod 6 (Figs. 4 and 5). Each of the said sleeves is preferably provided with two circular rows of balls 11 and 12 contained in a case 13, in order to reduce the mechanical resistance to a minimum (Fig. 5).

Each piston is provided with a roller 14 which is advantageously mounted on a ball bearing, and the rollers of each pair of pistons act upon a cam 15 of special form, whose outline is such that the output of a unit which comprises two pairs of pistons and hence two cams displaced by 90° apart, shall be uniform and without cyclic

variations, according to known practice, in order that the said units may be coupled together without taking account of the relative angular position of the successive units.

The two cams 15 of the unit are keyed to or integral with a shaft 16 which is perpendicular to the axis of the cylinders and is terminated at both ends by a member 17 having a polygonal outline, each face of the polygon being preferably in the form of a cylinder whose axis intersects the axis of the shaft 16.

The liquid under pressure is admitted through a conduit 18 (Fig. 1) and enters a separator 19 in which the gas bubbles which it may contain are collected and are discharged through an upper vent 20 (Fig. 2) which may if desired be controlled by a float-valve, according to known practice. From the lower part of the separator, the liquid freed from gas is lead to the corresponding measuring unit through a conduit 21, from which it proceeds into a casing 22. From the said casing, it is circulated through the orifices 23, when these are opened by a slide-valve 24, into the corresponding cylinders 2 whose pistons 3 act upon the cam 15, thus rotating the central shaft 16.

The orifice or orifices 23 which communicate with the interior of the valve 24 serve at this time for the discharge of the liquid, which is expelled by the other piston or pistons and is circulated as shown by the arrows in Fig. 3, into the space 25 between the pistons, whence it is discharged to the exterior through a conduit 26 (Fig. 1) connected with the general discharge head 27.

The special flat slide-valve 24 is preferably controlled by a vertical shaft 28 by means of two bevel gear-wheels 29 and 30. The said valve has a square shape, and carries at its centre a shaft which is rotatable in a crank 32 secured to the upper end of the shaft 28. A gear-wheel 33, which participates in the rotation of the shaft 31 and the valve 24, is in constant engagement with a pinion 34 (Figs. 3, 4, 6), carried at the end of a small intermediate shaft 35 which is rotatable in the crank 32 and which carries at its lower end a pinion 36 in constant engagement with a stationary toothed ring 37 coaxial with the shaft 28. The pinions 34 and 36 on the one hand, and the rings 33 and 37 on the other hand, have the same number of teeth. In consequence, according to known practice for planetary gearing, the valve 24 will have a circular movement about the shaft 28 but without rotating on its own centre. In particular, all points of the valve will describe equal circular trajectories, and thus the wear will be uniformly distributed upon the working surface, and hence the tightness will be maintained. The valve 24 is movable upon a flat part comprising four orifices 23 which are located on the sides of a square, and each orifice communicates with the outer end of one of the cylinders, respectively.

The said cylinders are closed at their outer end by covers 38 which form part of the distributing conduit. It will be seen from Fig. 4 that the said conduit leads to the lower part of the cylinder, and that the cover 38 is so constructed as to reduce the dead space in the cylinder to a minimum. Accordingly, the current of liquid will draw forward the solid impurities which are thus prevented from accumulating in the cylinder, and on the other hand, the greatly reduced dead space will further the expulsion of any gas bubbles occurring in the cylinder, which expulsion is facilitated by a small orifice 39 in the inner wall of the cover 38 adjacent the upper generatrix of the cylinder.

A shaft 40 extending through the upper wall of the casing 41 in a stuffing-box, may serve for the driving of a suitable indicator.

The movable parts such as shafts, piston-rods, guide-sleeves, cams, etc., with the exception of the pistons themselves and the distributing valve, can be assembled and verified outside of the body of the apparatus. For this purpose they are mounted on a frame 42 (Figs. 3 and 5) forming the lower cover of the body of the unit 1. In this way it is possible to remove, check, repair if necessary, and replace the said parts without being obliged to remove any piping. In like manner, the valve 24 can be verified and replaced by removing the cover 41 without disconnecting any of the piping.

Before mounting in place the frame 42, the units are assembled together, preferably by internal bolts 43. It is obvious that they may be assembled by bolts situated at the exterior of the unit, without departing from the principle of the invention.

In order to facilitate the mounting and removal of the frame 42, the shafts 16 of the various parts are connected together by connecting means, each of which consists of a tube (Fig. 3) of polygonal section fitting upon the members 17. Each tube 44 comprises a solid wall 45 near one end, and a spring 46 bearing at one end upon the wall 45 and at the other end upon the member 17, serves to hold the tube 44 in place.

It is an easy matter, after removing the covers 38 and the pistons 3, to push the tube 44 against the action of the spring 46 (to the left of Fig. 3) in order to release the member 17 and to lower the frame 42 with all its parts. This operation is facilitated by the cylindrical form of the faces of the member 17.

Although the method of assembling the units by bolts 43 provides for a rigid assemblage, the method of connecting the shafts 16 together will provide for the proper working of the whole device, even on the occurrence of a bending action or a defective alignment.

All of the sections of the piping 18 and 27 and of the separator have the same length as the measuring unit, and thus they can be assembled by flanges and bolts in order to form continuous tubes (Fig. 2).

Both ends of the separator, as well as the end of each of the two heads which is not in use for the flow of the liquid, are closed by bolted end-pieces. It will be observed that it is thus possible to increase the output capacity of a meter already installed, by simply adding extra units.

It will follow from the preceding description that if p is the loss of pressure for one of the units A, B, C traversed by an output q, a meter consisting of n units will operate with a loss of pressure p equal to that of a single unit, while producing an output $q+n$ which is proportional to the number of units.

This will afford a great facility of adaptation, as with a given pressure, which may at times be too low for the operation of known meters it will always be possible to obtain any desired output, without limitation, simply by forming the meter by means of a sufficient number of units. Another important advantage afforded by the invention is the possibility of keeping up a great number of meters having different capacities ex-

actly adapted to each case, by means of a small number of spare parts.

Finally, the construction of the apparatus, which is confined to a small number of different parts, may be carried out on a high production basis, and provides for the use of improved tool outfit and process which assure a most approved manufacture with a minimhm cost.

As each unit comprises an outgoing shaft **40**, it is possible to operate several indicating devices, such as a normal indicator, a preliminary determining device, a distant transmission device, etc.

Figs. 7 to 9 show a modified form of slide-valve controlling the distributing orifices **23**. It this modification, the four distributing orifices **23**, each corresponding to a cylinder, are no longer situated according to the sides of a square, but according to a circle concentric with the valve driving shaft **28**.

The valve **47** itself has a circular form. It comprises two imperforate diametrically opposite parts **48** and **49** which serve to close the orifices. It further comprises an aperture **50** connecting the orifices with the admission of the liquid, and a conduit **51** connecting the said orifices with the middle part of the meter where the liquid is discharged to the outside. The valve is centered on the shaft **28** by a recess **52** in which is engaged the upper end of the shaft **28** with a very slight play.

The valve is rotated by means of a single roller **53** rotatable on an axle secured to a hub **55** keyed to the shaft **28**. The roller **53** engages in a notch **56** of obtuse-angled shape which is formed in an internal projection of the valve **47**.

A thrust ball bearing **57** is located between the hub **55** and the body of the apparatus. A safety pin **58** secured to the said hub is inserted into a recess of larger diameter at the upper end of the valve **47**.

It will be apparent that the said valve is pressed upon its seating by the pressure of the admitted liquid, which fills the chamber containing the said valve.

Owing to the form of the valve, the resultant of this pressure is at P, and an essential feature of the invention is that the roller **53** is precisely placed under this resultant.

The operation is as follows. The liquid being admitted into the apparatus, its pressure will tend, on the one hand, to apply the valve **47** upon its seating, and on the other hand, by acting on the pistons, to rotate the shaft **28**. The roller **53** now acts upon one of the inclined sides of the notch **56**, and its force can be decomposed into two components, i. e., a tangential force tending to rotate the valve **47**, and an upward vertical force tending to raise the valve. As this force, by construction, is in direct opposition to the resultant of the pressure, there will be no tilting torque upon the valve.

This vertical component diminishes the force which applies the valve upon its seating, until the resulting friction torque is sufficiently reduced to allow the tangential component to operate the valve.

The device is self-regulating, and the valve can never be lifted from its seating. In fact, the friction torque cannot become nill, for when it is equal to or less than the torque produced by the tangential component, the valve is rotated, and thus the vertical component which tends to lift the valve will always be less than the resultant of the pressure which tends to apply it to its seating.

Obviously, the invention is not limited to the embodiments herein described and represented, which are given solely by way of example.

It is evident that the separator, as well as the supply and discharge heads, may consist of one-piece tubes provided with necks whose number corresponds to the ňumber of units employed. without any change in the working and obviously without departing from the spirit of the invention.

As above indicated, if the output to be measured is less than that of a unit, it is evidently feasible to use such a unit separately.

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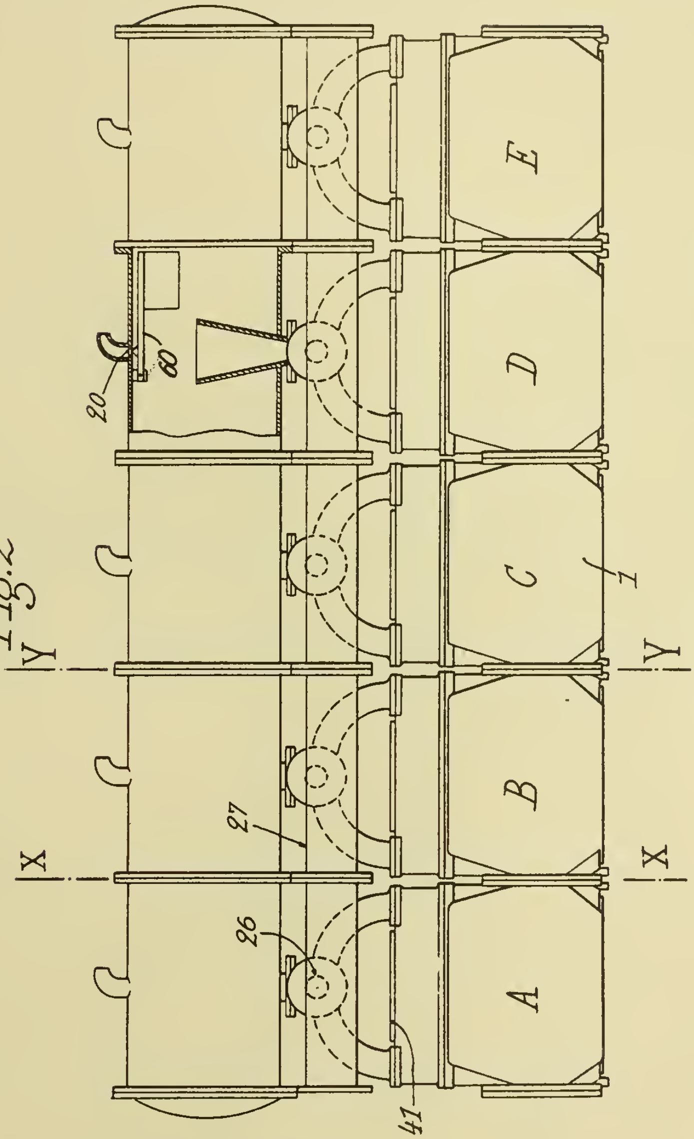

Fig.2

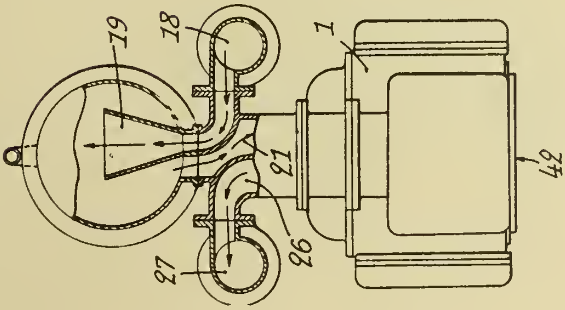

Fig.1

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Fig. 3

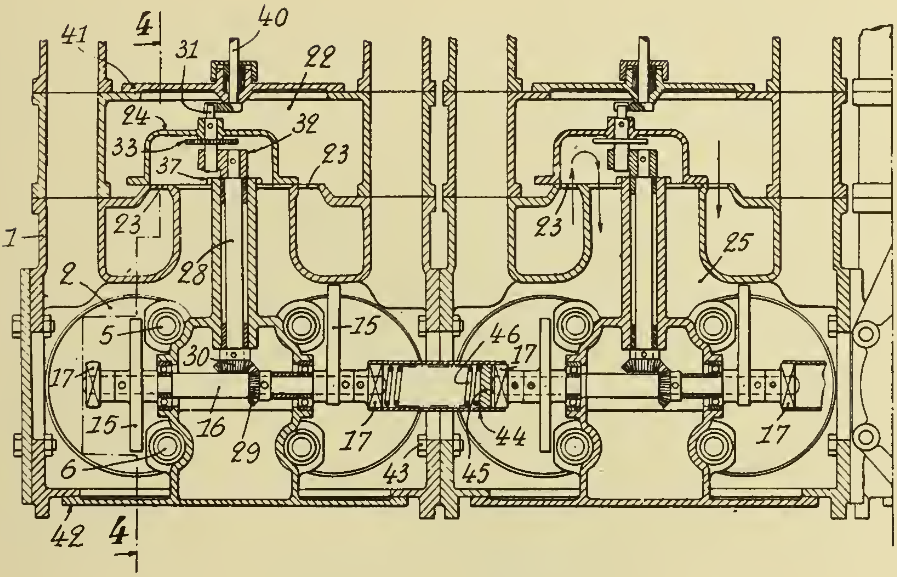

Fig. 4

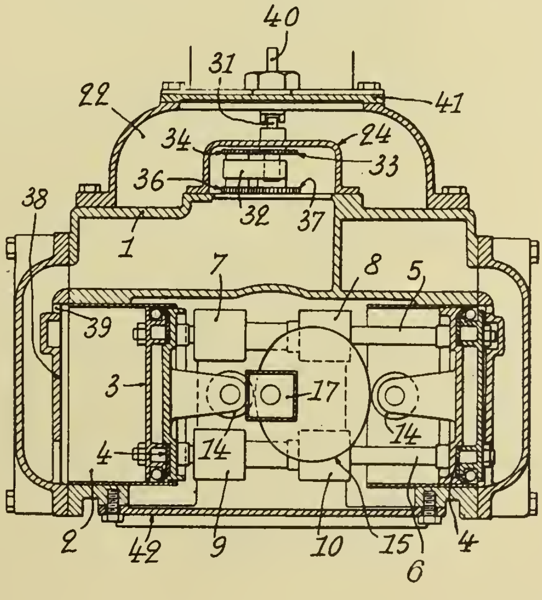

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Fig. 5

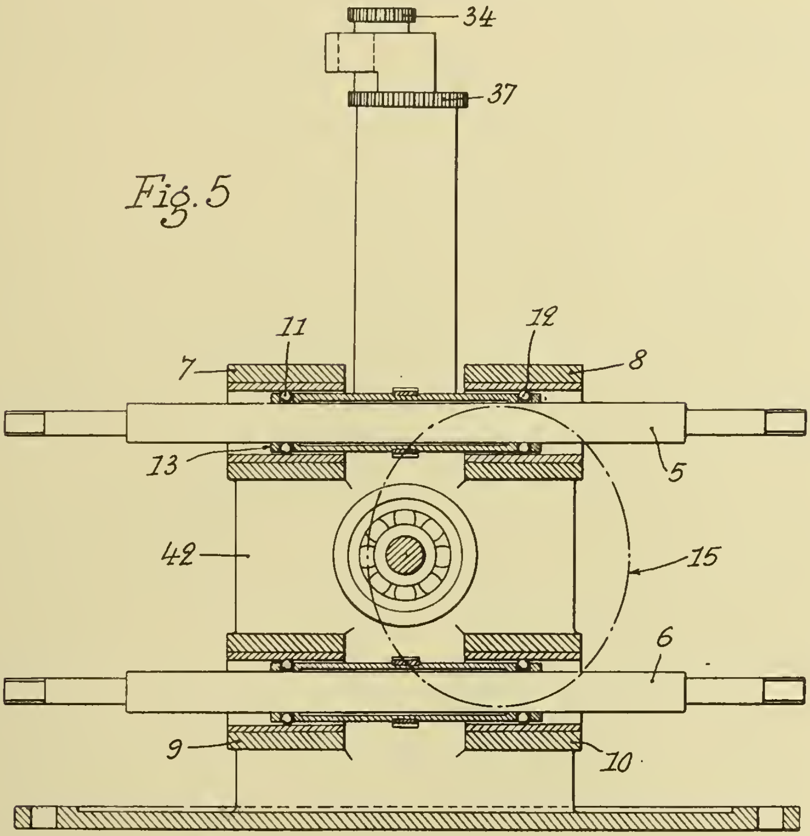
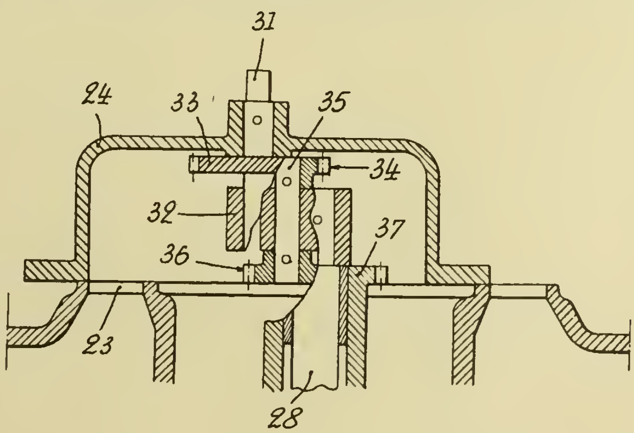


Fig. 6



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ALIEN PROPERTY CUSTODIAN

BACKWARDS LOOKING GLASS FOR AUTOMOBILES AND OTHER VEHICLES

Miklós Rosner, Budapest, Hungary; vested in the Alien Property Custodian

Application filed April 21, 1939

Every vehicle especially automobiles are usually furnished with a glass placed in front of the driver, showing the road behind the carriage. This glasses are generally fastened to the carriage in a position showing the space behind the car which is to be surveyed in the most favourable way. Therefore it can be perceive well what kind of vehicle is approaching to the carriage supplied with this glass.

Often is demanded that the glass driving mirror fastened to the carriage could be used by the driver or other persons for personal purposes what by the until now employed methods, for the fixation of the glass was not practically possible in the moving car. The application of globular joints, for that purpose is not a sufficient solution for the fixation of the glass.

It is very important during a long journey the use of the glass in the moving car for cleaning the clothes, shaving, and other purposes, this was naturally by the until now usual fixed construction of the glass impossible.

The invention gives the possibility for travellers without disturbing the driver but also for the driver to lift the glass with one hand out of his place or move it, and afterwards to put it back in the before determined position and fix it there without any use of particular resources.

The essential part of the invention is a backwards looking glass for automobiles and other vehicles fastened directly or indirectly to the carriage without use of tools or other resources by a connection mechanically fixing, but soluble or changeable, the advantageous fixed and unchanged mutual position of glass and carriage is secured by soluble mechanical construction.

The glass can be fixed in the most advantageous position by bayonet setting or elastic jaws or latches or by some by hand soluble other connection. The glass can by, according to the invention after being lifted out of the fixed position, connected with the car by a spring, elastic girdle or flexible elastic wire. This spring or elastic wire draws back the glass into the original position and fixes it directly or by aid of some particular construction automatically.

The invention can be nearer explained by hand of the enclosed figures showing an example of the invention.

Fig. 1. is a perspective image of the backwards looking glass.

Fig. 2. is a perspective image of the setting and fixing construction of the glass.

Fig. 3. the side view of the setting and fixing construction of the glass.

The glass driving mirror **1** respectively his setting is leaded in the cutting out **4** of the care **3** by the bolt **2** respectively fixed like a bayonett setting. The cutting out is formed in the way that the nose **5** of the bolt **2** fixes the glass in the final position. In the final position in Fig. 3 the glass is fixed by the aid of the nose of the bolt **2** in the case **3**. Now the glass **1** is fastened to the car by the aid of arm **6** in the most advantageous position for looking backwards. Against eventual shocks protects the pressure of the spring on the lower plate of bolt **2**. If we want to lift the glass we have after having pressed it in a little, to turn it until the nose **5** fastened to bolt **2** comes in the cutting out to the place parallel to the axis of the bolt: in this position the glass can be lifted out of case **3**. The glass will be replaced by putting it back into the case in a way, that the nose **5** of the bolt **2** will fit the cutting out **4**. Then you press in the glass into the case until nose **5** lies close to the place on the border of the cutting out vertical to the axis of the bolt. Then you turn the glass until nose **5** arrives in the position marked on the cutting out **4**. This corresponds with the first most advantageous position of the glass for looking backwards.

The glass is therefore fastened to the vehicle by soluble connection, can be lifted out with only one hand an by replaced and fixed in the original position.

The invention is naturally not restricted to the described partical execution, every soluble or changeable connection may be used. It may be employed as connection between vehicle and glass a joint construction maintained also it the glass is moved away from the original backwards looking position. It is important in this case also that the glass can to be replaced automatically and compulsorily in the original backwards looking position.

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Fig. 1.

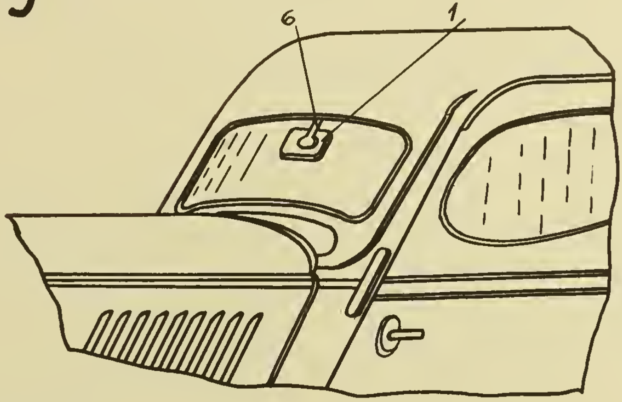


Fig. 2.

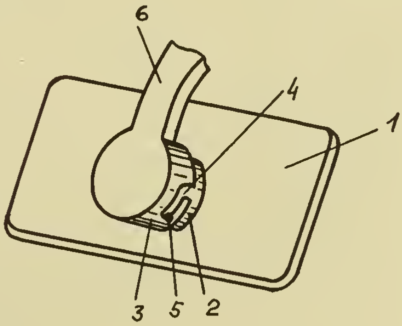
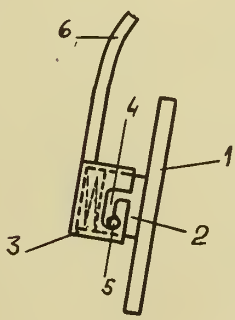


Fig. 3.



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PROCESS FOR THE PRODUCTION OF STEEL FROM PIG IRON

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Application filed May 5, 1939

For the conversion of pig iron into steel, it is known to use the blast converting process or the open hearth refining process or a combination of the blast converting process and of the open hearth refining process. The simplest, most efficient and most economical process for converting pig iron into steel is the blast converting process. In the case of the blast converting process it is possible to carry out the process either as an acid process (Bessemer process) or as a basic process (Thomas process) according to the composition of the pig iron. In the case of the acid process, which is still used on a large scale in the United States of America, the silicon is the main heat carrier. The pig iron contains about 1 to 2% Si and about 0.5% Mn. The phosphorus content must be low (considerably less than 0.1%) as a dephosphorization does not take place on the acid lining. The manganese content must also be low, as the manganese attacks the acid lining very actively and is besides lost on being converted into the acid slag. Occasionally higher percentages of manganese have been treated on acid lining. However, this is only in the case of emergency on account of the above reasons. In view of the present day position of raw materials it would be entirely wrong to blast on an acid lining pig iron with a high percentage of manganese.

The blast converting process on acid lining can supply only a small portion of the steel production, as $\frac{9}{10}$th of the whole of the existing iron ores contain phosphorus. Consequently, when working on acid lining, there usually only remains the expediency of preliminarily converting in the converter and finishing (dephosphorizing) in the open hearth furnace. The blast conversion on basic lining allows of direct blasting to steel even in the case of ores rich in phosphorus. The phosphorus content in the case of the basic process, is the main producer of the quantities of heat necessary for the production of steel. In view of the use of the slag as fertilizer a phosphorus content of at least 1.8% is necessary. The pig iron generally available to-day for the basic blast conversion mostly has approximately the following composition:

P 1.8—2%, Mn 0.6—1.2%, Si 0.2—0.5%

Occasionally, Thomas pig iron with a higher percentage of Si has been blasted to-day by way of experiment. In view of the saving in manganese the manganese content has recently been reduced in Germany to 0.6–0.8% as compared with the former content of 1.0–1.2%. The quantity of manganese necessary for the production of Thomas steel and introduced into the Thomas pig iron mixture is almost completely lost. For this reason iron with a higher percentage of manganese has never been blown in Thomas converters, except in works where the earth base naturally brought a higher percentage of manganese into the Thomas pig iron, for example in the Thomas Works at Peine. Moreover, this higher percentage of manganese represents another disadvantage for the Thomas process in losses of iron and manganese, as iron slagging occurs and consequently the waste becomes greater as the manganese content increases.

The present day position of raw materials compels exceptionally high steel charges in the Siemens Martin furnaces, which leads to exceptionally great difficulties in the running, because higher percentages of manganese in the charge have an extraordinarily great disturbing effect on the course of the reactions in the case of the open hearth refining process. At a corresponding state of the raw material conditions it is often necessary to treat 80 to 100% steel iron with a higher percentage of manganese and normal or higher percentage of silicon. The exceptionally great difficulties of a metallurgical kind, and the abnormally high expenses incurred by this method of treatment are known in the industry. It has been endeavoured, with the aid of open hearth refining mixers, to remove a small portion of the carbon and the greatest part of the manganese and of the silicon and to finish the melting in a second hearth furnace. In the case of manganese percentages far exceeding 1.8%, considerable difficulties arise also in the preliminary converter combined with high expenses. Moreover, the treatment with preliminary refining mixers is much more expensive than the ordinary basic S. M. process and the waste is much greater because the preliminary refiner converts 20% and more iron into slag.

Hitherto it was considered as not practical to blow to steel in the basic converter a steel iron with higher manganese content in the order of 1.5 to 5% manganese, 0.5 to 2% Si, 0.1 to about 0.4% P and 0.07% S or a Bessemer pig iron of similar nature with phosphorus amounting to 0.1% and more. The invention does away with this prejudice and proposes to work such a pig iron into steel also in the basic converter. At the same time it is particularly advantageous to ensure an undisturbed blowing process and to attain the desired final analysis with the greatest possible degree of accuracy by following certain

measures. In putting the invention into practice it has been found particularly advantageous to allow the burning of the associated elements with the iron, particularly the manganese and carbon, to take place as uniformly as possible so as to attain the desired final steel product with the greatest degree of accuracy as regards temperature and also the analysis, and also as regards the waste.

An example of this method of working is illustrated in the accompanying diagram. The melting therein illustrated has been regulated in such a manner that the carbon and manganese burn uniformly and after the burning of the carbon the dephosphorisation sets in satisfactorily.

According to the invention this course of the reactions is attained by adding, according to the quantities of Si, Mn and P in the pig iron, a cooling medium (scrap, ore or lime) the quantity of which is determined merely by experiment. The time when the addition has to be made depends upon the behaviour of the melting during the blasting. With the same analysis the course of the reactions very often varies within wide limits during the blasting, owing to the different temperature of the pig iron in state of delivery and to its other properties, in a similar manner to that also known in the Thomas process. It is then necessary, when watching the blasting process, to add the cooling medium at the suitable moment. The correct time is recognized by the phenomena of the discharge and the nose flame also known in the Thomas process. For example it has been found to be correct, in the case of a steel pig iron containing 2.5% Mn, 0.55% Si and 0.15% P, to add a quantity of lime equal to 3% of the weight of the charge at the beginning of the blowing, 2% cooling scrap after 3 to 6 minutes blowing and an additional 1½% of cooling scrap after 6 to 10 minutes blowing.

By this method it is possible to reduce the Si content to traces, the carbon content to about 0.02% the phosphorus content to about 0.05% and the manganese content to 0.3 to 0.4% and at the same time to attain a temperature which is necessary for the casting of steel. The advantage of this method consists in that a slag is now obtained which is suitable for producing specular iron with for example max. 10% Fe, 18 to 20% Mn, about 20% SiO_2 and about 30% CaO, with a yield of 90% related to the metallic charge.

The new process allows a small quantity of slag with high percentage of manganese to be obtained, in that as little lime as possible is added beyond the theoretical quantity necessary for binding silicon and phosphorus. Moreover, the manganese content in the final product can in this manner remain so high that no manganese carriers need be used for the deoxidaton, at the most some phosphorus free steel iron for increasing the carbon. This means a considerable saving in manganese as compared with the ordinary blast conversion.

It is evident that in this manner a preliminary metal can be blown which is finished in known manner in the S. M. furnace. The above mentioned facts also apply for the production of this preliminary metal. It is possible by the same method to bring the carbon content of the preliminary metal, as in the case of the steel described, to within the limits of 0.5 and 1% and more, and at the same time the manganese content to about 0.80 to 1.5% and the silicon content to traces, according to the composition of the desired final product in the finishing furnace. The phosphorus content, however, remains then entirely in the preliminary metal.

By working according to the invention it is possible to produce a slag which can be worked to ferro manganese in that the slag after practically terminated decarbonisation is tapped before the burning of the phosphorus commences. In this case,, however, it is advantageous to tap the slag rich in silicon when the silicon burning is practically terminated, but before the decarbonization sets in, in order to prevent to a great extent a dilution of the slag rich in manganese to be tapped after the decarbonization.

An extremely great advantage of the blowing of steel iron in the basic blast refining converter is therefore the saving of manganese unsurpassed by any other process and the reduction of the waste. The necessary changing over to German ores allows occasionally conditions of production in which normal kinds of pig iron rich in phosphorus are obtained besides kinds of pig iron poor in phosphorus and rich in manganese. The basic blast converting process allows alternately an immediate changing over from the ordinary Thomas pig iron process to the blowing of steel iron rich in manganese.

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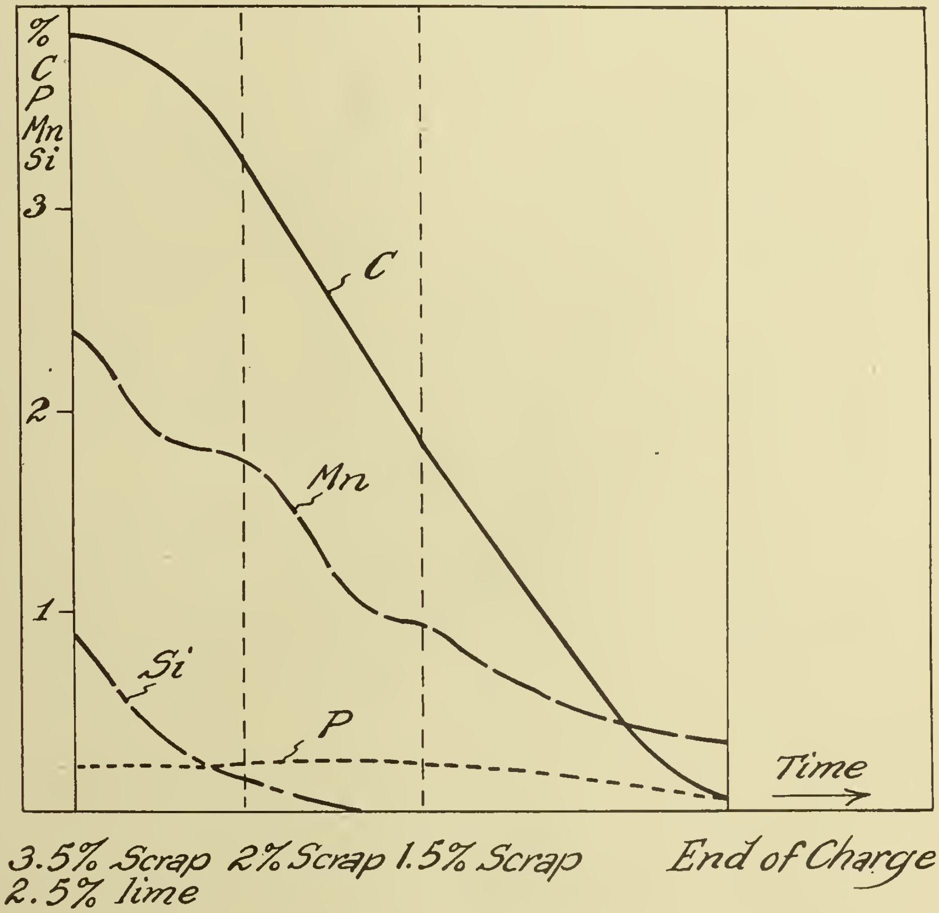
272,044

Example of a Steel Iron Charge



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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF LOOP-PLUSH FABRIC

Max Nebel, Chemnitz, Germany; vested in the Alien Property Custodian

Application filed May 9, 1939

This invention relates to knitted loop-plush fabric.

In the known kinds of loop-plush fabric the plush loops forming the velvet-like pile are those sinker loops that are made longer than the ground fabric sinker loops from a second thread otherwise worked together with the ground fabric. In loop-plush fabric of this known type plush loops may be knit into every sinker loop or provided only above some of them, for instance every other sinker loop.

These kinds of loop-plush fabric are, however, open to the objection that in the direction of the wales between the sinker wales worked with plush loops spaces appear which are more or less conspicuous, depending on the greater or lesser thickness of the plush thread relative to the ground thread. As there are certain limits to thread thickness in all knitting machines, the plush thread cannot be made so much thicker than the ground thread to eliminate these open spaces, apart from the fact that the needle mesh in the ground fabric would acquire thereby an undesirable thickness. Furthermore, these open spaces are found also to a less conspicuous degree in the direction of the courses, since the plush loops in each course emerge exactly side by side from the face of the goods at the base of the sinker loops.

It is the object of the invention to overcome these defects of the known loop-plush fabric by tying the plush thread into the ground fabric in such manner that each of two plush threads worked into each course is alternately knit together with a needle mesh of the ground fabric to form a needle mesh. In each course the plush loops are therefore alternately formed of one of the two plush threads and each plush loop has twice the width of the sinker loop so as to extend from one limb of the ground fabric sinker loop to the other limb of the adjacent ground fabric sinker loop across the interposed needle mesh and thus to cross or overlap the adjacent plush loops.

The step of crossing the loops as applied to loop-plus fabric affords the above-mentioned advantages compared with the known plush thread connection in which the plush loop does not cross a needle mesh but constitutes only an extended sinker loop.

The invention relates also to the method of producing this new loop-plush fabric whose essential feature is that of two plush threads sunk longer than the ground thread in a course one thread is knit with the ground thread into a mesh by every other needle and the other thread by the interposed needles. Since according to the invention the plush loops are made so as to correspond in width to a double needle division, it becomes possible to eliminate the drawbacks which appear particularly in the knitting of the known loop-plush fabric having plush loops provided above every sinker loop and which are due to the fact that the plush thread is drawn out much longer than the ground thread and must therefore stand much higher tensions and speeds than the ground thread.

According to the invention, each of the two plush threads of a course is worked only at every second needle into plush loops with the result that the stressing of the plush thread during operation is equal to that of the ground thread. Any thread employed for the ground fabric may therefore serve also as plush thread and the plush loops may be much longer than at present.

The invention is illustrated in the accompanying drawing by way of example, which shows specimens of loop-plush fabric made according to the invention and in which

Figure 1 shows regular plain fabric with plush loops arranged in accordance with the invention;

Fig. 2 is a cross section of the loop-plush fabric on the line I—I, of Fig. 1; and

Figs. 3 and 4 show two kinds of plain fabric in which the ground-thread loops are formed in a special manner and the plush loops are arranged according to the invention.

The ground fabric shown in Fig. 1 is of the ordinary plain type and made from the thread 1. In each course two plush threads 2 and 3 are alternately knit into plush loops 2^a and 3^a each of which has twice the width of the sinker loop, i. e., each plush loop is not as in known loop-plush fabric positioned at the width of the ground fabric sinker loop between the needle meshes but passes from one limb of the sinker loop across the needle meshes to the other limb of the adjacent sinker loop. The limbs of the plush-thread sinker loops above one ground-thread loop alternately consist therefore of two kinds of thread.

As clearly shown in Figs. 1 and 2, the broad plush loops do not lie in one line side by side in the direction of the course but are alternately disposed once in front and then again in the rear of the two adjacent loops. The plush loops occupy therefore in the direction of the course a greater width in space than in single loop plush fabric and fill better the space between the mesh heads, whereby not only the empty spaces or lanes in

the direction of the wales are omitted but also those extending in the direction of the course are filled up much better than in ordinary loop-plush fabric.

In the fabric shown in Figs. 1 and 2 loops from the ground thread and the two plush threads are therefore knit by all needles during one loop-forming step. Furthermore, one plush thread of a course, which in known manner is drawn out longer than the ground thread, is worked into a mesh together with the ground thread by every other needle, and the other plush thread, also drawn out longer than the ground thread, is formed into a mesh together with the ground thread by the interposed needles.

The method of producing the loop-flush fabric shown in Fig. 3 differs in so far as the course is composed of two successively worked partial courses. During the knitting of one partial course ground-thread loops are formed only above every other needle and only one of the two plush threads, after having been drawn out longer than the ground thread, is worked by these alternate needles into a mesh together with the ground thread. During the following sinking operation the second partial course is knit in which the ground thread is worked into a mesh by the needles that have not participated in the loop-forming step in the first partial course while the plush thread, also drawn out longer than the ground thread, together with the ground thread is made into a mesh by the needles participating in the loop-forming step in this partial course. These two partial courses shown in Fig. 3 together form a closed course, the only difference compared with the closed course shown in Fig. 1 being that the needle meshes and therefore also the plush loops are not arranged in a straight line but are somewhat staggered in the direction of the wales. This racking results in the known diagonal arrangement of the ground fabric needle meshes, and this ground fabric is therefore usually called "diagonal" fabric.

The loop-plush fabric shown in Fig. 3 possesses the same arrangement of the plush loops as the fabric shown in Fig. 1, with the difference, however, that owing to the knitting of a closed course from two partial courses the needle meshes in the course and wales are displaced relative to one another. The plush loops like those shown in Fig. 1 have twice the width of the sinker loops and passing over the adjacent plush loops cross the needle meshes.

The method of producing loop-plush fabric as shown in Fig. 4 is practically the same as the one described with reference to Fig. 3 except that after the working of a course from two partial courses during the knitting of the first partial course of the next course first those needles form loops again which in the preceding course have been operative in this respect during the working of the second partial course. Figs. 3 and 4 show these needles in cross section, the needles forming loops **5** being designated **5**^{a} and those forming loops **6**, **6**^{a}. If therefore the loops **6**, by the operation of every other needle of the row, have been made into a partial course and the second partial course has been formed of the loops **5** by the interposed needles, the needles will form partial or full courses in the production of the loop-plush fabric shown in Fig. 4 in the following order:

First course:
1st part. Course: Needles **6**^{a} form the loops **6** and plush loops **2**^{a}
2nd part. Course: Needles **5**^{a} form the loops **5** and plush loops **3**^{a}

Second course:
1st part. Course: Needles **5**^{a} form the loops **5** and plush loops **3**^{a}
2nd part. Course: Needles **6**^{a} form the loops **6** and plush loops **2**^{a}

Third course:
1st part. Course: Needles **6**^{a} form the loops **6** and plush loops **2**^{a}
2nd part. Course: Needles **5**^{a} form the loops **5** and plush loops **3**^{a}, etc.

When producing loop-plush fabric of the kind shown in Fig. 3, the needles operate, however, as follows:

First course:
1st part. Course: Needles **6**^{a} form the loops **6** and plush loops **2**^{a}
2nd part. Course: Needles **5**^{a} form the loops **5** and plush loops **3**^{a}

Second course:
1st part. Course: Needles **6**^{a} form the loops **6** and plush loops **2**^{a}
2nd part. Course: Needles **5**^{a} form the loops **5** and plush loops **3**^{a}

Third course:
1st part. Course: Needles **6**^{a} form the loops **6** and plush loops **2**^{a}
2nd part. Course: Needles **5**^{a} form loops **5** with plush loops **3**^{a}, etc.

This method of producing the ground fabric is known per se, and it is further known that when the needles are operated in the first manner the needle meshes of two partial courses unite to form a course in which the needle meshes lie in a straight line as in the fabric shown in Fig. 4, whereas if the needles are opererated in the second order the two partial courses remain drawn out in the direction of the wales, as shown in Fig. 3. The method can be applied by known means on knitting frames and machines.

MAX NEBEL.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

M. NEBEL

PRODUCTION OF LOOP-PLUSH FABRIC

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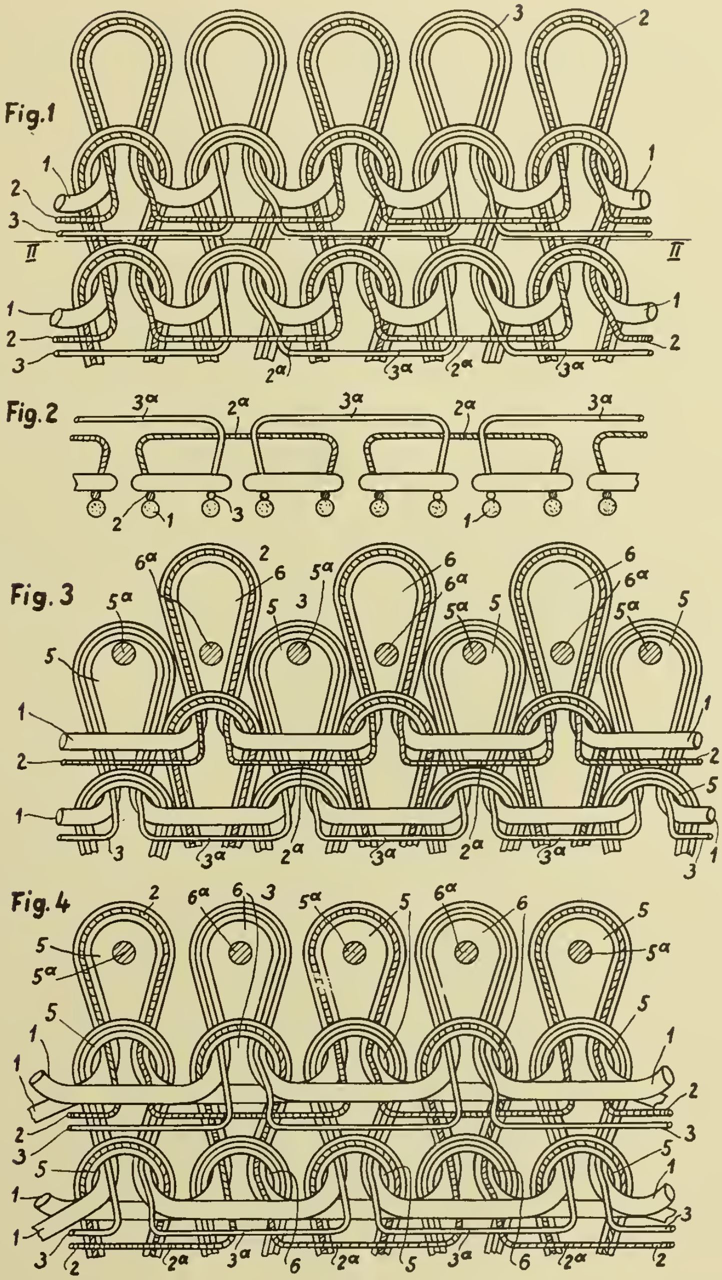

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF YEAST PREPARATIONS

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No Drawing. Application filed May 13, 1939

The present invention relates to a process for the production from plasmolyzed yeast of yeast preparations containing, in a stable form, the vitamins and other active constituents of yeast.

It is known that yeast can be plasmolyzed by the addition of electrolytes, by the addition of water-soluble substances which are non-electrolytes, such as sugars, and finally by the addition of organic solvents, e. g., ethyl acetate. During the plasmolysis the active constituents of yeast are set free and converted into a sensitive, easily changeable form.

It has already been proposed to convert yeast plasmolysates into the solid state by means of flour or cocoa powder. For dietetic foods, for which the yeast preparations according to this invention are particularly intended to be used, water-insoluble flour or cocoa powder is however but little suited. In addition, plasmolysates solidified with flour or cocoa powder are very easily infected with molds and similar micro-organisms.

It has also been proposed to convert sensitive substances into dry preparations by the addition of waterfree electrolytes, such as sodium sulfate, sodium carbonate and the like, in anhydrous form. The use of anhydrous electrolytes suffers however from the disadvantage that the high electrolyte content renders the administration of the preparations per os practically impossible.

To obviate these disadvantages, it is proposed in accordance with the present invention to plasmolyze the yeast by known methods, e. g., by the addition of electrolytes or sugars, whereupon the plasmolysate thereby obtained is subsequently converted into dry preparations by the addition of sugars. For this purpose it is particularly advantageous to use the sugars, e. g., glucose, maltose, lactose and the like, in anhydrous form, whereby the advantage is gained, amongst others, that with a relatively smaller amount of sugar a quicker drying and a better protection of the sensitive, active constituents of yeast is obtained.

By the process according to the present invention the water contained in the plasmolysate is combined with the sugars employed, and the active substances of the plasmolysate are simultaneously adsorbed on to the sugars. Thus the active substances of the yeast plasmolysate are stabilized particularly mildly. The stabilization takes place in a manner which is considerably more sparing than that consisting in mere thickening or solidification of the plasmolysate by means of flour or cocoa powder.

The new preparations exhibit a particularly high content of vitamins and other active substances and contain these substances in an extraordinarily stable and active form. It is also to be noted that the sugars serving as carrier for the active substances of the yeast are easily decomposed in the body, and do not act as difficultly digestible ballast substances, as do, e. g., flour and cocoa powder.

As initial material for the process according to the present invention there may be used both bottom- and top-fermentation cultured yeasts, especially brewers' yeasts, and also wild varieties of yeast, e. g., growth-, mineral- or mold-yeasts.

For carrying out the plasmolysis, sugars are preferably employed, in order to obtain preparations as free from electrolytes as possible. The yeast is freed from bitter substances by known methods, if desired, and treated with about an equal weight of sugar. As soon as plasmolysis is complete—the duration of the process varies with the age of the yeast, its water content and the like—a further quantity of sugar, amounting to about one and a half to four times the amount of yeast used as initial material, is added and thoroughly mixed. There is thus obtained a crumbly mass which may extremely easily be dried, e. g., by allowing it to stand in the air or by passing air over it. The use of high temperatures, which may lead to spoiling the physiologically valuable ingredients, is not necessary. Plasmolysates which, for the separation of solid constituents, have previously been centrifuged, may also be submitted to the process according to the present invention.

The process according to the present invention will be further illustrated by the following examples, but the invention is not restricted to the quantities and times given in these examples.

Example 1

1 kg. of fresh, pressed and washed brewers' bottom-fermentation yeast, which has been freed from bitter constituents by customary methods if desired, is vigorously stirred with 1 kg. of glucose in an agitator until complete plasmolysis has set in, which requires about 20 minutes. The plasmolysate obtained is then stirred with a further 2 kg. of anhydrous glucose for about 15 minutes, whereby a crumbly, powdery mass is produced which can easily be dried by passing air over it.

Example 2

1 kg. of fresh, pressed and washed brewers' bottom-fermentation yeast, which has been freed

from bitter constituents by customary methods if desired, is vigorously stirred with 250 g. of maltose in an agitator until complete plasmolysis has set in. The plasmolysate obtained is then stirred with a further 2.5 kg. of maltose. whereby a crumbly, powdery mass is produced which can easily be dried by passing air over it.

Example 3

1 kg. of fresh, pressed distillery yeast, which has been freed from bitter constituents by customary methods if desired, is vigorously stirred with 500 g. lactose in an agitator until complete plasmolysis has set in. The plasmolysate obtained is then stirred with a further 2 kg. of anhydrous lactose whereby a crumbly, powdery mass is produced which can easily be dried by passing air over it.

ERWIN BUMM.

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ALIEN PROPERTY CUSTODIAN

EGG YOLK-LIKE PREPARATION

Karl Kremers, Stuttgart, Germany; vested in the Alien Property Custodian

No Drawing. Application filed May 16, 1939

My invention relates to a new nutritive material and more particularly to a preparation which is similar to egg yolk.

It is an object of my invention to provide for a new foodstuff of the kind of egg yolk.

It is another object of my invention to produce this new preparation from ingredients other than natural egg yolk and more particularly to prepare same with the use of albumin compounds contained in milk.

The following constituents of the substance of the yolk of hen's eggs are of considerable importance for the practical use of egg yolk:

Vitellin, lecithin, cholesterol and the fatty compounds margarin and elain.

Lecithin and cholesterol impart to the protein vitellin the capacity of emulsifying and, similar as the fatty compounds, they cause that the egg yolk can be used to a large extent in the art of baking, which property is substantially due to the fact that the egg yolk is an emulsion-like composition of the substances mentioned.

It has been established by experiments that the protein or albumin called vitellin can be replaced by milk albumin in suitable state. Moreover the egg lecithin may be replaced by vegetable lecithin without the emulsifying properties deteriorating in comparison with the natural composition. Other fats or oils may be employed instead of fatty compounds of the natural yolk and the relation between lecithin and fat occurring in the egg yolk may be altered to a large extent in favor of the lecithin without impairing the qualities which are important for the employment of the product and more particularly for the baking. It is economically of great importance that fat may thus be replaced by lechithin, since lechithin is less expensive than fat and is available in large quantities as a secondary product occurring in the treatment of soy beans.

Moreover, kafir or kefir albumin and more particularly an emulsion of kefir and fat or kefir and oil may be used to a certain extent instead of lechithin.

I thus succeed in composing a substitute for egg yolk from milk albumin, vegetable lecithin and fatty compounds or oils.

The process of preparing this substitute may be carried out in various manners.

The milk albumin or protein may be homogenised immediately in natural or precipitated form and in pure state or together with its natural accompanying substances, such as milk sugar, fatty bodies and the like, with lecithin. The lecithin may be employed as such alone or dissolved in oil or substances containing fat or in a composition with such substances.

The milk proteins may however also be deaminized, so as to become more similar to the protein of egg yolk. Not only the micellar structure of the milk protein is changed by this conversion, but also the color, which at the pH values characteristic of the substance of egg resembles to lutein.

By emulsifying these de-aminized albumins with vegetable lecithin and suitable oils or fats one can obtain a preparation which in physicochemical respect is similar to egg yolk and which may replace the egg yolk in the preparation of food, pastry and paste articles.

The essential properties, to which the applicability of egg yolk owes, for instance its flavor qualities and its specific heat energy as occurring in the physiological combustion, are present to the same extent in the preparations obtained according to my invention from milk protein. By an addition of these new preparations the porosity of the pastries becomes more uniform and the baker's ware more spongy. The baker's wares furthermore remain fresh for a longer time, when the new substances are added to them, in consequence of the fat content of same.

The emulsifying efficacy of the products may further be increased by an addition of mucilages, for instance tragacanth or agar, or of cellulose-like compounds, for instance methyl cellulose. Butter fat or other fats or oils with or without a content of lecithin, may also be used instead of lecithin, if simultaneously methyl cellulose is added as emulsifier.

All the substances mentioned above allow to convert the milk albumin, which otherwise cannot be plainly employed to replace egg yolk in the art of baking, into a product which with respect to the properties important for the art of baking is equivalent to egg yolk. By means of these preparations, similar as by means of egg yolk, there may for instance be produced foamy bodies containing sugar, or creamlike bodies, or mayonnaises.

The following examples illustrate the invention and the manner in which it may be performed without in any way limiting its scope.

Example 1.—1000 kgs. precipitated casein with a water content of approximately 65% are thoroughly kneaded in a drum apparatus with 1 kg sodium nitrite or the corresponding quantity of the pickling salt commonly used in butchery; 1.5

kgs. glacial acetic acid, which has priorily been diluted with 10 kgs. water, are gradually added. The mixture thus obtained is allowed to rest during several hours and is thereupon washed with acidified water.

To the product thus obtained alkalies, for instance ammonia, are added in a quantity required in order to cause the product to swell and subseqently to dissolve it. A pH value of above 7 is obtained therein.

This solution is thereupon homogenised at suitable temperatures with 85 kgs. vegetable lecithin, which has been dissolved in 290 kgs. vegetable oil.

The emulsion thus obtained may be dried, for instance by spraying it.

It has been found that already a starting phase of the emulsion, viz. the de-aminized protein, can be used as a substitute of egg yolk, for instance in the production of paste articles. It is also possible to replace in the production of the new preparations the whole or part of the volatile alkali by solid alkalies, especially by alkaline calcium compounds. By the use for instance of calcium hydroxide (calcium oxydatum hydricum) a preparation is obtained which is very similar to natural egg yolk.

Example 2.—1000 kgs. precipitated casein with a content of about 65% water are treated with that quantity of alkali, for instance ammonia, which is necessary for causing the casein to swell and to be thereupon dissolved, wherein a pH value of more than 7 is obtained. The solution thus produced is homogenised thereupon with 85 kgs. vegetable lecithin, dissolved in 290 kgs. vegetable oil, at a temperature at which the solidified lecithin is liquefied, thus for instance at about 40° C. The emulsion thus prepared may be colored in any known manner, for instance by an addition of a suitable dyestuff, and may then be dried by an atomizing process.

As has been mentioned above, milk with its content of cream or skimmed milk may be used instead of casein. The proportion of quantities is calculated in this case in accordance with the content in casein.

10,000 kgs. skimmed milk would for instance be required in the example given above, provided that the skimmed milk contains 3.5% casein. The skimmed milk is preferably thickened according to any known method to at least the fourth or a still smaller part of its volume and then treated according to my process described above. Milk which has not been skimmed may be treated in a corresponding manner.

Wholesome alkaline earth compounds, such as basic calcium compounds, may be used instead of the alkalies mentioned above for the swelling and dissolving treatment described.

Other fats, such as butter fat, may likewise be used instead of vegetable oil.

The lecithin may wholly or partly be replaced by substances, such as mucilage, with emulsifying capacity.

Various changes may be made in the details disclosed in the foregoing specification without departing from the invention or sacrificing the advantages thereof.

KARL KREMERS.

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ALIEN PROPERTY CUSTODIAN

ALTIMETERS

Walter Springer, Berlin-Steglitz, Germany; vested in the Alien Property Custodian

Application filed May 20, 1939

The present invention relates to improvements in altimeters, which, as is known, have to be provided with a device for correcting the barometer level existing at any moment. Before reading the instrument a second reference pressure indicator has to be set to the pressure actually existing at ground level, in order that the reading on the altitude scale shall be free of error.

Hitherto the necessary correcting arrangement has generally been constructed with a second scale graduated in millimeters of mercury or millibars and connected with the meter mechanism, which is disposed behind the dial and is read off against a mark through an aperture in the dial. This scale is sufficient for a comparatively small range of pressure variation, such range being characterised roughly by the maximum and minimum barometer levels. But a larger range is becoming increasingly necessary, on account of the fact that landing grounds at considerable altitudes, up to say 2500 m., now come into question. For such altitudes it is necessary for the correction range to be extended considerably, and the difficulty then arises of providing a reference scale of length corresponding to the large pressure range. In addition to being governed by the pressure limits, the length of the scale is also determined by the precision with which the pressure can be adjusted. In this connection one cannot go below a certain minimum degree of accuracy of reading, for example one graduation per millibar, and the spacing of the graduations must be large enough to enable say half a millibar to be estimated with reasonable accuracy. The difficulty here arises that altitude and pressure are connected to one another by a logarithmic function so that the scale of the reference indicator is compressed towards one end.

The invention enables both the range and the accuracy of reading to be increased as much as is desired. The chief new principle upon which the invention is based consists in using a thin tape as a carrier for the reference pressure scale. This tape is wound onto two coiling elements or spools, between which it can be wound to and fro, running from one onto the other and vice versa, a short free portion between the spools running past the reading window. Since a tape for example 4 to 6 m. in length when wound up only forms a small reel a few centimetres in diameter, the tape can be conveniently installed in the case of the altimeter. With a length of some metres available for the scale, it is possible for the accuracy of reading even with a range of 850–1050 millibars, to amount to $\frac{1}{10}$th of a millibar at the most compressed part of the scale. In addition, owing to the positive logarithmic connection between the two scales, a strip has particular advantages as compared with those known arrangements which use for the reference pressure a counter mechanism that advances step by step in decimals. In such a case an element has to be provided between the reference indicator and the altitude indicator which evolves the logarithmic relationship. Such an evolving device however, can only be accurate to a very limited degree. Relatively high accuracy for example, $\frac{1}{10}$–$\frac{2}{10}$ millibar, cannot be achieved by such an arrangement, which has to solve the barometric altitude formula graphically. The tape arrangement is entirely free of such an evolving element with its consequent limited accuracy, since as a result of the continuous scale carrier the graduations for each fraction can be provided exactly at the theoretically correct places. The tape itself consists preferably of metal, for example stainless steel, to provide maximum safety against tearing or breakage and great constancy of length.

In carrying the basic principle of the invention into constructive effect the particular problem has to be solved of ensuring that each point of the tape always corresponds to the same position of the meter mechanism, independently of the direction of motion. This requirement can be met, for example, by perforating the tape and by causing the gear wheel effecting the displacement of the meter mechanism simultaneously to drive the toothed wheel engaging in the perforations, but Figures 1 to 5 of the accompanying drawings illustrate embodiments of the invention in which such perforation is unnecessary, the requisite synchronisation between the positions of the tape and the meter mechanism being achieved by a simple, durable and, in particular, absolutely reliable arrangement.

In order that the invention may be clearly understood and readily carried into practice, reference will now be made to the accompanying drawings, in which the invention is illustrated by way of example and in which—

Figure 1 is a diagrammatic front elevation of an altimeter according to the present invention.

Figure 2 is a horizontal cross-section illustrating one method of driving the reference pressure tape, the view being taken from beneath, so that the free part of the tape is on the far side of the plane of the drawing,

Figure 3 illustrates a detail of Figure 2.

Figure 4 is a view, similar to Figure 2, of an al-

ternative embodiment of the invention, of which Figure 5 illustrates a detail.

Figure 6 illustrates a form of tape for use in altimeters according to the invention.

Referring to Figure 1, **1** and **2** are the two spools, **3** is the tape. The spools are driven by means of the gear wheel **4** and the externally operated gear wheel **5**. The meter mechanism is driven either from the spindle of the gear **5** (Figures 2 and 3) or from the spindle of the spool **2** (Figures 4 and 5). The gear **4** meshes with gear **6**, which is rigidly connected to spool **2**, and on rotation of gear **4** in the direction of the left-hand arrow (Figure 2) the tape is wound onto spool **2**. Spool **1** is not rigidly connected with the gear wheel **8**, but through the intermediary of a spring washer **9** gear **8** exerts pressure on the side of spool **1**, so that the tape being withdrawn by spool **2** is kept taut by friction. When gear **4** is rotated in the direction of the right-hand arrow (Figure 2) the tape is unwound from spool **2**, but now spool **1** is also driven in the direction for winding up the tape coming from spool **2**. This is effected by means of a ratchet wheel **7**, fixed on the same spindle as gear **4** (Figure 3) which carries along a pawl **10** of a further gear wheel **11** mounted loosely on the same spindle and which meshes with gear **8**; as mentioned above, the latter is frictionally coupled to spool **1**. The bellies of the spools are of different diameter, that of spool **1** being equal to the diameter of spool **2** with the tape wound thereon. As a result the length of tape that can be wound up by the draft of spool **1** is greater than the length of tape positively unwound by spool **2**. The difference between draft and feed is compensated by slipping of the frictional clutch between spool **1** and gear **8**.

The important point in this connection is that the length of tape moved in both directions is governed by the rotation of one and the same spool **2** only. Since spool **2** is rigidly coupled to the mechanism drive by way of gear **4**, this means that the same position of the mechanism always tallies with the same point of the strip in both directions of rotation. Moreover, no error is possible due to the increasing diameter of the spool as the tape is wound thereon, since the instrument is calibrated with this dependency taken into account. Calibration is actually effected when construction of the instrument has been completed by marking on the reference scale the exact millibar value based on the altitude formula for each value of the altitude scale. In this way the effect of the changing spool diameter is completely eliminated, since the calibration of each point of the tape is carried out in conjunction with the positive common displacement of the two scales, that is to say including the alteration in diameter that takes place.

In Figures 4 and 5 an alternative construction is illustrated. In Figure 4 the gear **12** is the one that is driven by the manually operated wheel **5**. It is carried firmly on a spindle with gears **7** and **13** (Figure 5). Similarly to gear **7** the gear **13** has ratchet teeth so that the gear **15** can be clutched in one direction of rotation by means of the pawl **14**. The teeth of gear **7** and the position of pawl **10** are opposite to those of gear **13** and pawl **14**. Either one or the other of the two gears **15**, **11** is entrained in each direction of rotation. The gear **15** meshes with gear **6** and gear **11** with gear **8**. The gear **8** is rigidly attached to spool **1** and gear **6** is rigidly attached to spool **2**. Spool **2** is braked in the same manner as spool **1** by a spring washer **16**. Instead of the clutches by means of ratchet wheels and pawls that are illustrated, the known free-wheel type of clutch can be used with advantage. In the construction according to Figures 4 and 5 the meter mechanism is driven from one of the two spool spindles, such for example as the spindle **17** of spool **2**, or from a gear wheel that is governed by one of these spools.

In the constructions illustrated by way of example the spool spindles are parallel to the longitudinal axis of the case, and consequently the tape has to be bent in a right angle to run past the window with its face parallel to the front surface, but of course it is quite possible to arrange the spools so that their axes are perpendicular to the axis of the case, when the bending of the tape can be avoided.

The figuring can be impressed in the tape. To ensure facility of reading, even in the dark, the figures may conveniently be made by perforations (Figure 6), when an area of luminous colour the size of the whole reading window is provided behind the tape.

WALTER SPRINGER.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

W. SPRINGER

ALTIMETERS

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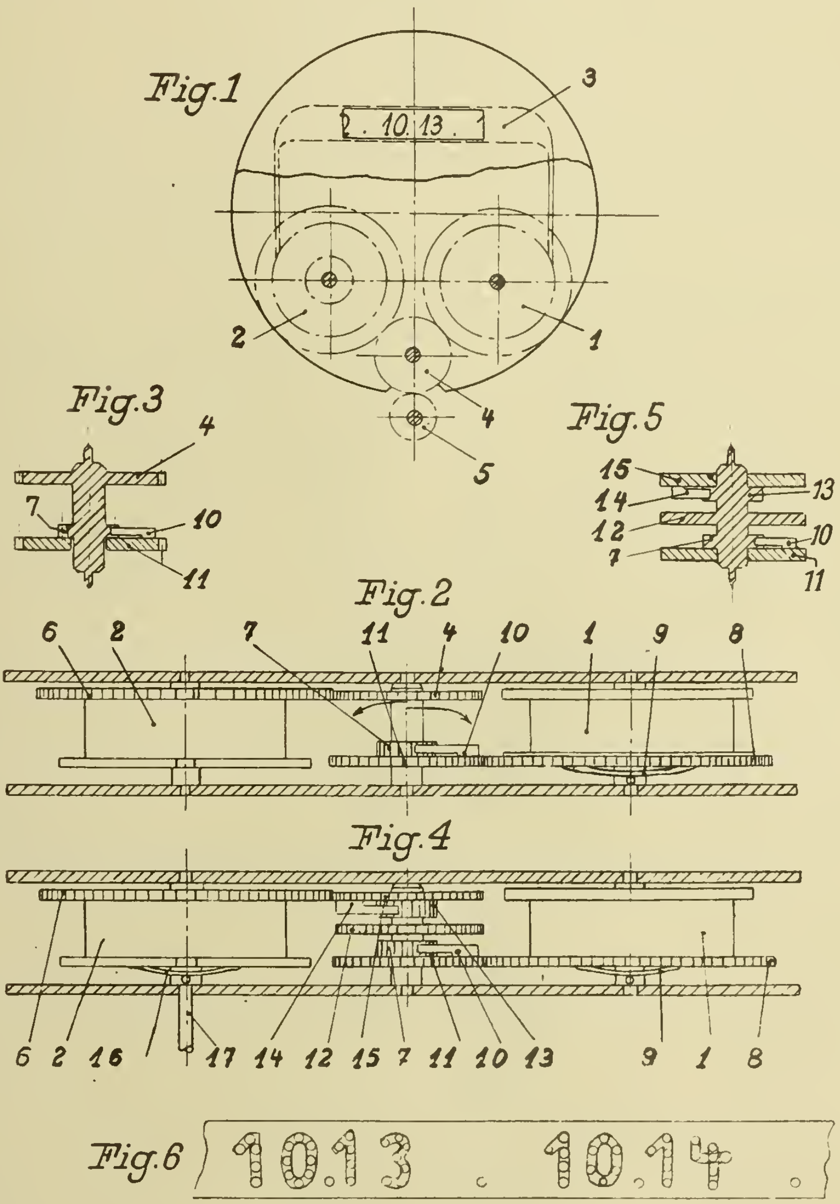

Inventor:

Walter Springer

By A. D. Adams

Attorney

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Serial No. 276,093

ALIEN PROPERTY CUSTODIAN

PROJECTILE FOR PERFORATING BORE HOLE CASINGS

Marcel Schlumberger, Paris, France; vested in the Alien Property Custodian

Application filed May 27, 1939

The present invention relates to shooting devices, and more particularly to apparatus for perforating the metallic casings usually inserted within bore holes after drilling. More specifically the invention relates to a new and improved projectile construction for perforating metallic bore hole casings, although it is not limited to such use.

Heretofore perforating projectiles of this character have generally been formed with a conical forward portion and a cylindrical rear portion, and have been fabricated entirely out of hard steel. It has been found from long experience that these projectiles do not always make clean holes in the bore hole casing. In some cases the holes formed by the projectile have rough and projecting edges which are undesirable particularly inside the casing where they may interfere with the motion of instruments such as packers, pumps, etc., necessary for the production of the well.

It also happens that projectiles become jammed when penetrating the casing but before leaving entirely the barrel of the gun, causing the gun to be stuck in the well due to the smallness of the annular space between gun and casing.

Moreover, previous perforating projectiles can be discharged only from a gun having a barrel of the same diameter as the projectile itself so that it is necessary to provide as many different guns as there are projectiles of different size.

A primary object of the present invention, accordingly, is to provide a new and improved projectile construction for perforating a bore hole casing, which enables a greater impelling force to be developed in its discharge than has been possible heretofore, so that cleaner holes may be produced. This greater impelling force will also allow a greater depth of penetration through several concentric casings which may be cemented together.

Another object of the invention is to provide an improved projectile which can be loosened easily should it become accidentally wedged between the gun and the casing.

A still further object of the invention is to provide an improved projectile construction of the above character which enables holes of different diameter to be made in a bore hole casing by the same gun.

The objects of the invention are attained by providing a composite perforating projectile which comprises essentially an inner core of hard and relatively heavy metal such as, for example, hardened steel and an outer sheath preferably formed of a light and somewhat friable material such as, for example, an aluminum alloy. The projectile is so constructed that the soft outer sheath is torn away from the core as soon as it is discharged from the gun, and only the hard steel core pierces the metallic bore hole casing. It is also proposed to design the outer sheath so as to facilitate its removal from the hard core when discharged from the gun, as is described in greater detail below.

It will be readily seen that the improved projectile construction of this invention enables a much greater impelling force to be achieved for any given projectile diameter than has been heretofore possible, because the impelling gases produced by the combustion of the powder are directed against the rear surface of the outer sheath, which is considerably larger than the rear surface of the perforating core itself. Moreover, inasmuch as the total weight of the core and the sheath is less than the weight of a homogenous steel perforating bullet having the same caliber as the sheath, the initial speed developed by the perforating core itself is greater than the initial speed of a homogenous steel bullet of same dimensions. In addition, the principal section of the core is considerably less than that of the outer sheath, so that the friction and resistance to its advance, after being separated from the sheath, both in the fluid in the hole and in the casing itself, are much less.

Other features of the invention will appear from the following detailed description of several embodiments taken in connection with the accompanying drawings in which;

Figure 1 is a vertical section of a perforating projectile constructed in accordance with the invention, shown in firing position in a gun prior to discharge therefrom;

Figure 2 is also a view in vertical section of the projectile shown in Figure 1 just after discharge from the gun, illustrating the manner in which the outer sheath is torn away from the inner core;

Figure 3 is a view in perspective of one form of sheath which has been slitted in order to facilitate its removal from the core when the projectile is discharged from the gun;

Figures 4, 5, 6, and 7 illustrate further embodiments of projectiles constructed in accordance with the present invention.

Referring to Figure 1, a bore hole is shown at 10 which is provided with a metallic casing 11, and which contains the fluid 12. Within the bore hole 10 is a gun 13 of a well known type, for discharging projectiles for perforating the metallic casing 11. The gun 13, together with the associated equipment for raising it and lowering it within the bore hole and for igniting the powder, etc., are well known in the art, and need not be illustrated or described in detail here.

Located in firing position within the barrel 14 of the gun 13 is a projectile 15 constructed in accordance with the present invention. The pro-

jectile 15 comprises a cylindrical sheath 16 made of a light material within which is a perforating core 17. The material composing the outer sheath should have a strength sufficient to resist any shearing action at the firing moment. However, it should be soft enough to become separated from the perforating core 17 when ejected from the barrel. Light, non-malleable materials such as aluminum alloys or bakelite may be advantageously used.

The outer sheath 16 may be made in any desired form, although preferably it should not extend over the conical point 18 of the perforating core 17. It has been found that the removal of the sheath 16 by the resistance developed in its passage through the bore hole fluid is aided somewhat if its front edge is shaped so as to make a sharp angle with the surface of the forward portion of the perforating core 17, as shown in the drawings.

In order to prevent the fluid contained within the bore hole from entering into the powder chamber 19 of the gun 13 when the latter is lowered within the bore hole, packing 20 may be inserted in a circular slot 21 formed about the periphery of the outer sheath 16. In some cases, the outer sheath 16, being of relatively soft material, if closely fitted within the bore 14 of the gun 13, will prevent seepage of water or mud into the powder chamber 19 from the bore hole 10 without the necessity for any packing.

When the powder in the powder chamber 19 is ignited in the conventional manner, the combustion gases directed against the rear face of the outer sheath 16 impart to the entire projectile construction an impelling force of considerable magnitude which, because of the comparative lightness of the entire assembly, gives to the projectile a considerable initial velocity. Upon leaving the bore 14 of the gun 13, the projectile 15 passes through the bore hole fluid 12, and a very high resistance to its movement is developed, which tears the outer sheath 16 away from the inner core 17. Experience indicates that the sheath is usually completely torn off before the core has passed through the fluid between the gun 13 and the metallic casing 11 within the bore hole 10. The projectile core 17 thereupon becomes separated from the outer sheath 16 and is projected against the metallic casing 11 within the bore hole 10. At the same time, the forward motion of the fluid and of the outer sheath around the projectile core exercises on the part of the casing opposite it an important pressure which puts this section of casing under strain. This action will result in a very clean hole as the metal constituting the casing has less tendency to splash.

In order to facilitate the removal of the outer sheath 16 from the inner core 17, the sheath 16 may be weakened mechanically as, for example, by forming a plurality of longitudinal slits 21' therein, as shown in Figure 3. The outer sheath 16 may be designed in a wide variety of forms in order to facilitate its removal from the inner core 17, which forms will be apparent to one skilled in the art, and it is to be understood that all such modifications are to be comprehended within the scope of the present invention.

If desired, the rear portion of the projectile core 17 may be threaded at 22, the outer sheath 16 being correspondingly threaded to hold the core 17 securely within it, as shown in Figure 4. In this case the rear face of the outer sheath 16 may be dispensed with.

It will be noted that the projectile construction of the present invention enables the core 17 to be made of any desired shape. For example, its rear portion may be made conical as shown in Figures 5 and 6, or spindle shaped as shown in Figure 7, or any other shape designed to facilitate its penetration through the steel casing 11 or to reduce resistance to its movement.

In addition, the core 17 may be made of any diameter up to the diameter of the sheath 16. Thus the diameter of the core 17 in the embodiment shown in Figure 5 is less than that of the core 17 shown in Figure 6. It will be apparent therefore, that the projectile construction of the invention enables perforating projectiles of different diameter to be discharged from the same gun.

Due to the power necessary to perforate the steel casing, the gun cannot be built smaller than a certain diameter, and it frequently happens that the space between the gun and the casing is therefore small. Under such conditions, there is the possibility that a bullet improperly fired may not have the sufficient impelling force to entirely leave the barrel and penetrate the casing. In using a projectile which has an outer sheath of relatively soft material, it is possible to easily release the gun by a traction on the cable supporting it, without danger of breaking the cable. The effort required to loosen the projectile from the barrel will be relatively small, the outer sheath being easily removable from the steel core.

From the foregoing it will be apparent that the projectile construction of the present invention enables metallic bore hole casings to be perforated more readily and efficiently than has been heretofore possible. By providing a composite projectile it is possible to achieve a much greater impelling force than could be obtained with a solid projectile. Hence the holes perforated in the casing are cleaner, and the depth of penetration is increased. Moreover, by the use of an outer sheath of the same diameter as the diameter of the gun barrel used in its discharge, it is possible to use one gun for discharging projectiles of a wide variety of sizes up to the diameter of the gun barrel itself.

In the above description, aluminum alloys and Bakelite have been suggested as materials from which the sheath 16 might be made. It is to be understood that these materials are given merely by way of example, and the invention is not to be limited in any way thereby. Many other materials will suggest themselves to those skilled in the art, which will have the requisite strength to resist any shearing action at the firing moment, and yet which will be soft enough to become detached from the perforating core when the projectile is ejected from the gun, and it is intended that all such materials be included within the scope of the invention.

The specific embodiments described above have been given merely by way of example and the invention is not intended to be in any way limited thereby but is susceptible of numerous changes in form and detail within the scope of the appended claims.

MARCEL SCHLUMBERGER.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

M. SCHLUMBERGER
PROJECTILE FOR PERFORATING
BORE HOLE CASINGS
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Serial No.
276,093

Fig. 1

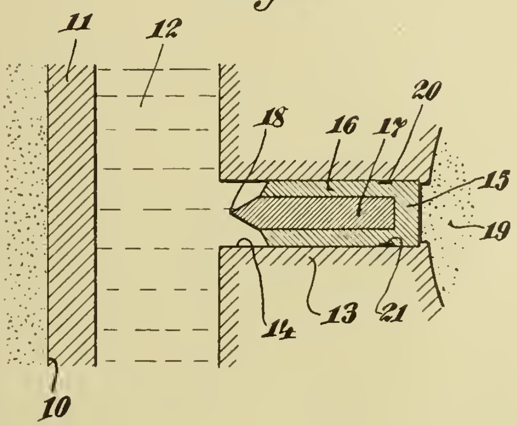


Fig. 2

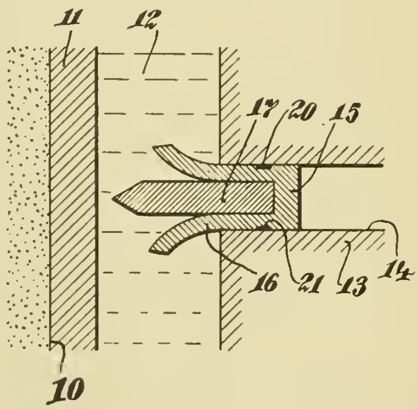


Fig. 3

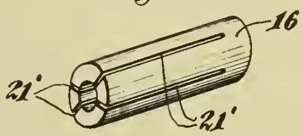


Fig. 4

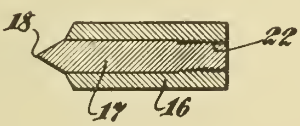


Fig. 5

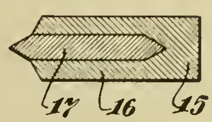


Fig. 6

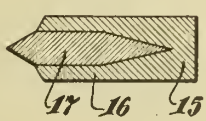
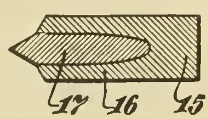


Fig. 7



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ALIEN PROPERTY CUSTODIAN

AMMUNITION CONTAINER FOR AIRCRAFT

Heinrich Hertel, Rostock, Germany; vested in the Alien Property Custodian

Application filed June 10, 1939

For machine guns in aircraft a full ammunition container and an empty ammunition container are mostly necessary. Both containers must be accommodated as near as possible to the gun so as to ensure perfect operation of the gun. The restricted space conditions in an aircraft, however, make it extremely difficult to find the necessary space in direct proximity to the gun.

Arrangements for accommodating the empty ammunition are known, in which the empty band is wound on a drum located at a distance from the gun, whereas the cases are thrown out into the open through an aperture. It is also known, to guide the ammunition band in the form of an endless link chain in a shaft extending in the longitudinal direction of the wing. The leading off of the cases into the open is open to considerable objections and also a link chain, because the full and empty band ammunition containers must be easily exchangeable.

The objections which have hitherto existed are overcome by the present invention. The full band container is constructed for accommodating the empty band and the empty ammunition. The empty ammunition is conducted into the space of the ammunition container becoming empty during the firing.

The full band container according to the invention has either foldable or slidable walls or both foldable and slidable walls, or the full band is guided along zig-zag paths over rollers or the like and the empty band is pulled into the space of the ammunition container becoming free during shooting. The full band box can be divided into several compartments which are arranged superposed or side by side. As soon as a compartment becomes empty the partition of the empty compartment is removed by the full band running out, so that the empty band can enter the opened compartment.

Another arrangement according to the invention consists in that the empty band space is shut off from the full band space by a flexible band. The flexible band is guided by a slide shiftable on the side of the box provided with a neck for the empty band.

The arrangement according to the invention may also be such that the full band in running off pulls the empty band into the position originally occupied by the full band. As the full band runs out of the ammunition container the empty band returns therein. The full band is stored in separate compartments formed by partitions and is conducted over rollers. Some of these rollers may be additionally driven by a suitable spring motor or the like; the drive can be controlled so that it only operates when firing.

Several embodiments of the invention are illustrated diagrammatically by way of example in the accompanying drawings, in which—

Fig. 1 shows an ammunition container in elevation,

Fig. 2 is a band contact release,

Fig. 3 shows an ammunition container according to Fig. 1 with two empty compartments,

Fig. 4 shows another arrangement of the compartments,

Fig. 5 shows an ammunition container of modified construction,

Figs. 6 to 8 show an ammunition container with movable roller guides for the ammunition band in several different stages of emptiness,

Fig. 9 shows a form of construction with stationary roller guides.

In the form of construction illustrated in Figs. 1 to 3 the ammunition box *a* comprises several compartments, *b*, *c*, *d*, *e*, whose size depends upon the number of shots which have to be fired. The compartments arranged one below the other contain the full band *f* in horizontal or in vertical position (Fig. 1 and Fig. 3). The full band *f* runs through a gun *g* and as empty band *i* through a passage *h* into the compartment *b* in which it is piled up. Guide rollers *k*, which may be intercoupled, guide the full and empty band. These rollers *k* may be driven for example by an electric motor which is controlled by the full band *f* through the intermediary of a contact switch *m*.

The compartments arranged one below the other are separated by flaps *n*, *o*. These flaps are drop flaps and, after the emptying of the compartments are released in a suitable manner by mechanical or electrical means by the full band *f* running over contacts *p*, so that the compartment located under the flap is opened for the reception of the empty band *i*.

In Fig. 4 another form of construction is shown, in which the compartments *r* are arranged side by side. The partitions *s* are foldable and oscillatable. They are under the action of springs *t* and released by contacts or unlocking pawls *u* on the guide plates *u'* and controlled by the full band *f* in running out. The pawls *u* always release the preceding partition *s* between two empty compartments *r*.

According to another form of construction (Fig. 5) the ammunition box *a* has a neck *s* for the

full band and a neck t for the empty band. The full band f runs out of neck s and returns into the box a as empty band i through neck t. On the side of the box provided with the neck for the empty band a guide with a rack or the like is arranged, in which a slide v can move up and down. The slide v comprises a spring motor w which moves the slide towards the bottom of the box. A stop x prevents the return movement of slide v. For filling the full band box the stop x can be disengaged by a suitable knob. A flexible band y is guided by guides z, rollers or other means on the slide v. The ends of the band y are fixed in the full belt box. During the downward movement of the slide v the band y finally assumes the position y^1 and thus forms a closed empty band space. The band y is held taut in any position by the slide v. The slide v reaches the position v^1 and in this position forms with the band y^1 the largest empty band space.

The ammunition container a, according to the construction illustrated in Figs. 6 to 9, is divided by a partition 1 of suitable material into separate compartments 2 in which the full band f and an end band 3 are arranged. The full band f runs to the gun g and after passing over suitable guides returns into the full band container a as empty band i. Both, the full band f and also the empty band i, are guided by pairs of rollers which consist of two rollers 5, 6 arranged one behind the other and connected by links 7. The full band f is fixed at the point 8 and the empty band i has its point of fixation at 9 through the intermediary of the end band 3. The full band f running out of the container in the direction of the arrow pulls the first pair of rollers 5, 6 into the position shown in Fig. 7 and successively all the pairs of rollers 5, 6 guided between the partitions 1 in the direction towards the full band box wall 10. While the full band f is running out, the empty band is pulled through the space 2 between the partitions 1 by the roller 5 of the pairs of rollers 5, 6. The ends 12 of the partitions may carry roller guides or similar means for assisting the guiding of the band. One pair of rollers after the other is brought out of its original position into its extreme position near the box wall 10, until the full band has been fired. The last portion of the full band may form an intermediate band 13.

The form of construction illustrated in Fig. 9 has partitions 14, at the ends of which stationary rollers 15 are arranged over which rollers the full band f and the empty band i are conducted. The full band and the empty band are connected to form an endless band. A driving mechanism, consisting of a suitable spring motor 16 or of similar means, may drive one or several of the guide rollers 15 to ensure an easy movement of the band.

HEINRICH HERTEL.

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BY A. P. C.

H. HERTEL
AMMUNITION CONTAINER FOR AIRCRAFT
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Serial No.
278,498
2 Sheets-Sheet 1

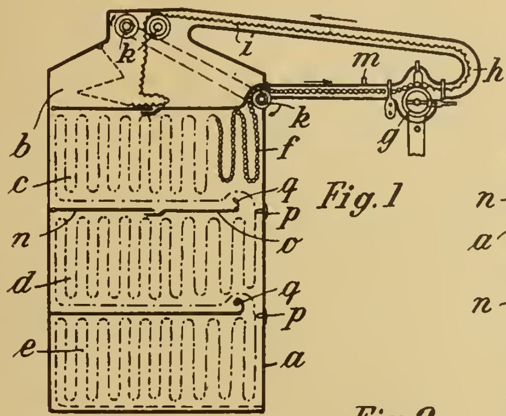

Fig. 1

Fig. 2

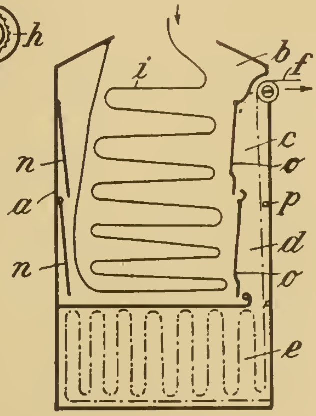

Fig. 3

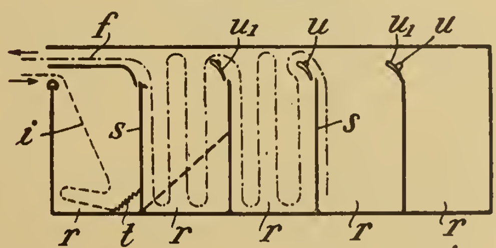

Fig. 4

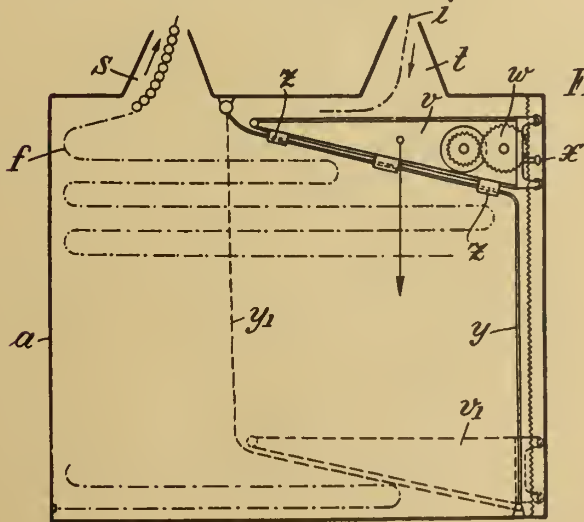

Fig. 5

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2 Sheets-Sheet 2

Fig. 6

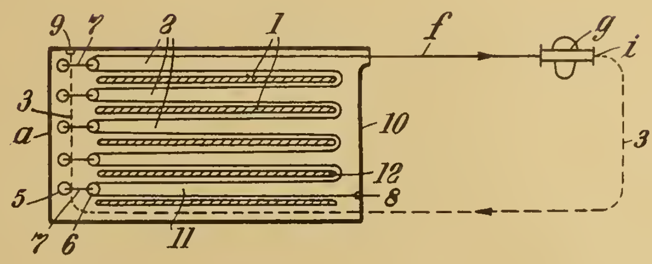


Fig. 7

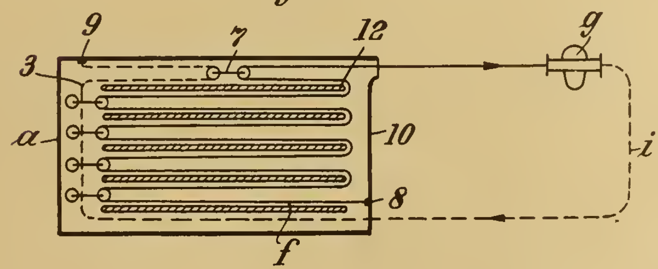


Fig. 8

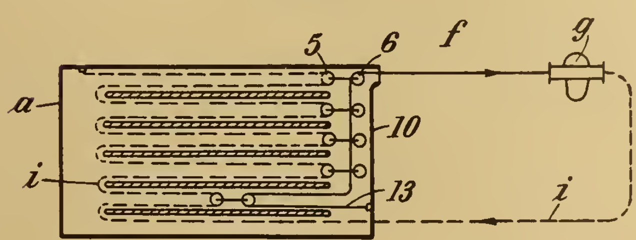
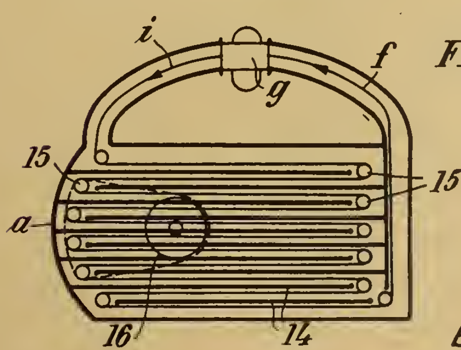


Fig. 9



Inventor
Heinrich Hertel

By

Attorney

Published May 4, 1943

Serial No. 280,046

ALIEN PROPERTY CUSTODIAN

APPARATUS FOR THE PRODUCTION OF PHOTOPRINTS

Max Weisz, Wien, VII, Germany; vested in the Alien Property Custodian

Application filed June 20, 1939

The invention relates to apparatus by means of which it is possible to prepare any desired number of photoprints in succession from the same negative without any further attendance excepting a single adjustment of the negative being required. Substantially, the apparatuus according to the invention is composed of a frame for accommodating the negative, of a source of light of adjustable position mounted above the said frame and fitted with an automatic current switch, of a printing plate capable of being moved up and down and subject to spring effect arranged below the frame, of a motion device by which the photo-sensitive printing paper coming from the roll is guided between the negative and the printing plate and by which the printing plate and, therewith, the photo-sensitive printing paper moving above the latter are from time to time pressed against the negative, and finally of developing, washing, fixing and washing tanks receiving in succession the photo-sensitive printing paper leaving the negative.

On the accompanying drawing the invention is represented in one of its embodiments assumed by way of example viz.:

Fig. 1 is a vertical section of the apparatus,

Fig. 2 is a horizontal section along the line A—B of Fig. 1,

Figs. 3 to 5 are detail drawings, Fig. 4 being a section taken along the line C—D of Fig. 3, whilst

Fig. 6 is the section of another embodiment of the apparatus.

On the drawing *a* denotes the negative, and *b* the fixed frame of accommodating the latter. Above this is mounted the source of light *c* the supporting arm *d* of which is capable of being slid up and down on the bar *f*, so that the source of light can be fixed in various positions relatively to the negative.

Below the negative *a* the clamping plate *g* capable of being moved up and down is located, the resilient force of the springs *h* endeavouring to keep the said clamping plate at a distance from the negative (Figs. 1 and 4.) Vertical bars *i* are projecting from the clamping plate *g*, the said bars projecting into the sleeve *l* of the frame *j* arranged below the clamping plate and guiding the motion in the vertical direction of the clamping plate. For moving the clamping plate, the motor *m* is employed (Figs. 1 and 5), on the shaft of which the worm *n* is provided with which the wormwheel *o* engages. On the shaft *p* of the latter there is mounted the gear wheel *r* the teeth of which are engaging with the teeth of the gear wheel *s* fitted with the cam *t*. Between the cam extension *t* of the gear wheel *s* and the clamping plate *g* the connecting rod *v* is arranged in an articulate manner (Fig. 1), the clamping plate being, during the rotation of the gear wheel *f*, pressed alternately by the said connecting rod to the negative *a*.

On the clamping plate *g* the electric switch *w* is provided (Fig. 4) which closes the circuit of the source of light *c* whenever the plate *g* is being pressed against the negative *a*.

The roll of photo-sensitive printing paper *y* is mounted in a rotatable manner on the frame *z*. The paper coming from the roll passes, guided by the rollers *l*, between the negative *a* and the table plate *g*, following which it gets between the pair of motion cylinders **2**, **3**, following which, guided on the rollers **4**, it passes into the developing tanks **5**, thence into the washing tanks **6**, thence into the fixing tanks **7**, thence into the washing tanks **8**, and leaving the latter, is led to the drying apparatus.

The cylinder **3** of the pair of motion cylinders **2**, **3** is connected with the motor *m* in such a manner that the gear wheel **9** keyed on the shaft *p* is, according to a known arrangement, periodically rotating the gear wheel **11**, the front plate of which latter is connected with the front plate of the wheel **12** mounted on the shaft of the cylinder **3** (Fig. 5).

That section of the printing paper *y* which extends up to the pair of cylinders **2**, **3** is being moved by the pair of cylinders **2**, **3** that section of the paper which gets beyond the said pair of cylinders is being moved by the chain wheels **13** driven by means of chain transmission by the motor. In order to ensure that, during the intervals during which the pair of cylinders **2**, **3** is at rest, it should be possible for the printing paper to continue its motion in the tanks **5**, **6**, **7**, **8** unhindered, a loosely hanging-down section of the printing paper is provided between the pair of cylinders **2**, **3** and the tank **5**, from which section the supply of paper during passage through the tanks is effected.

The method of operation of the apparatus is the following:

The motor *m* is through the intermediate transmission gears *n*, *o*, *p*, 9, **10**, **11** and **12** periodically rotating the pair of cylinders **2**, **3** through which the printing paper *y* coming from the roll and passing below the negative *a* is passing. It is the motor *m* likewise which through the intermediate gears *n*, *o*, *p*, *r*, *s*, *t*, *v*, is moving the printing plate *g* up and down. As soon as the plate *g* moving in the upward direction presses

the printing paper y to the negative a the switch W connects the current circuit of the source of light c, in consequence whereof photo-printing on the photo-sensitive paper y takes place. During this time there is no connection between the gear wheels **11** and **12** and accordingly the cylinder **3** does not rotate and leaves the paper y in stationary condition. After photo-printing has been effected the springs h are removing the plate g from the negative a, at the same time the current circuit of the source of light c is broken, the wheels **10**, **11** get into mutual engagement and the pair of cylinders **2**, **3** gets into rotation and removes the exposed section of the photo-printing paper from below the negative a.

During the upward and downward movement of the plate g the operation described above is continually repeated, in consequence whereof photo-printing takes place on new and new sections of the photo-printing paper. The paper y already photo-printed, leaving the pair of cylinders **2**, **3**, will first freely hand down along a section, following which it will, on the rollers **4** driven by means of the chain wheels **13**, be passed through the tanks **5**, **6**, **7**, **8** in which the developing, fixing and washing of the photo-printing paper takes place. Finally, the photo-printing paper leaving the tank **8** gets into the drying apparatus. During the time during which the photo-printing paper remains stationary below the negative a, the paper will continue its motion undisturbed in the tanks **5**, **6**, **7**, **8**, as this motion is rendered possible by the section of paper hanging down between the pair of cylinders **2**, **3** and the tank **5**.

Thus all that is necessary is to adjust the negative and to start the motor, whilst the photo-prints will be prepared by the apparatus automatically without any further attendance.

In the embodiment according to Fig. 6, the upper part **15** of the casing **14** of the apparatus, which is arranged above the frame b, can be tilted down around the hinge **16**. Above the frame b an enlarging apparatus **17** of known type is mounted, by means of which it is possible to prepare enlarged photo-prints from the negative.

The photo-printing and the developing device may also be constructed so as to be separate from each other.

MAX WEISZ.

PUBLISHED | M. WEISZ | Serial No.
MAY 4, 1943. APPARATUS FOR THE PRODUCTION OF PHOTOPRINTS 280,046
BY A. P. C. Filed June 20, 1939

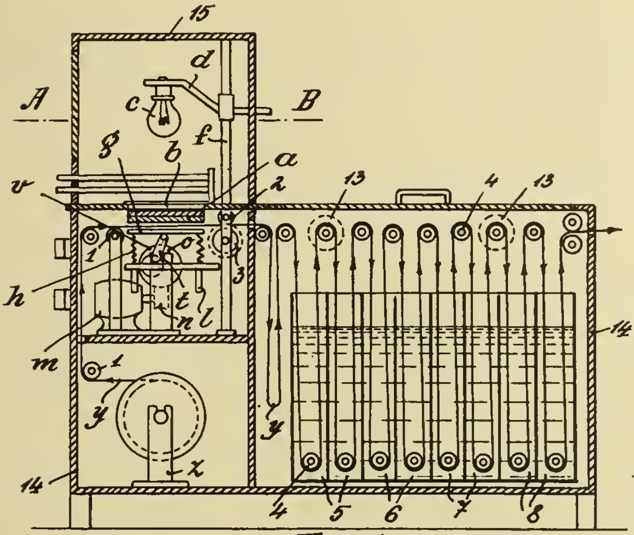


Fig.1.

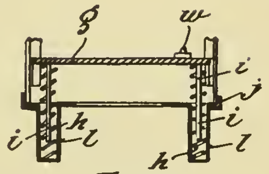


Fig.4.

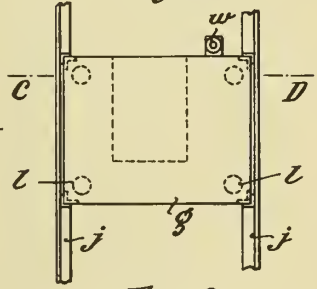


Fig.3.

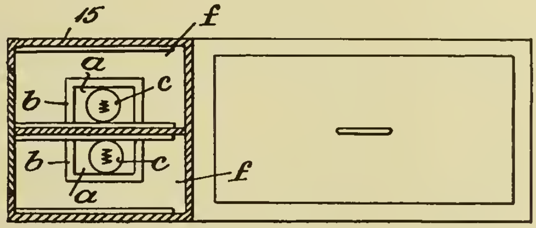


Fig.2.

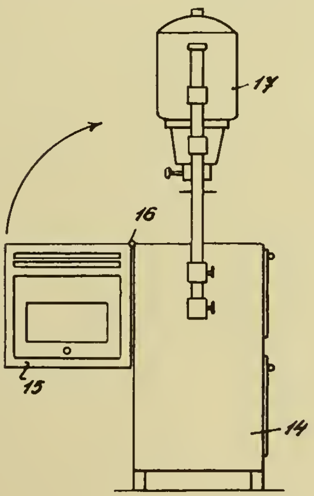


Fig.6.

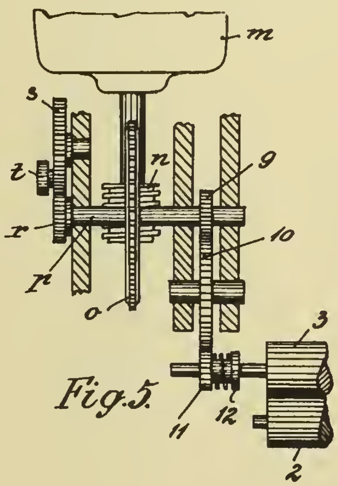


Fig.5.

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ALIEN PROPERTY CUSTODIAN

PRODUCTION OF FERTILISERS

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No Drawing. Application filed June 27, 1939

This invention relates to a process for the production of fertilisers.

For the production of fertilisers containing phosphoric acid compounds in a form easily assimilable by plants, from raw phosphates (rock phosphate), it has, for a long time, been known to decompose the raw phosphates with the aid of sulphuric acid. The so-called "superphosphate" thus obtained consists substantially of a mixture of monocalcium phosphate with an appreciable proportion of calcium sulphate. It is an object of the present invention to produce fertilisers of a similar nature while avoiding the large ballast of calcium sulphate contained in the "superphosphate" hitherto known. A further object of the invention is to increase the proportion of phosphoric acid compounds which is converted into assimilable form, practically the whole of the phosphoric acid content of the final product being present in the form of compounds which are both soluble in citric acid as well as ammonium citrate.

According to the present invention, raw phosphates are mixed with phosphoric acid, preferably of at least about 40% concentration (H_3PO_4 in H_2O) in a quantity sufficient to convert the whole of the lime contained in the raw phosphate and which is not already combined therein with phosphoric acid (i. e. particularly as is present as calcium fluoride and/or calcium carbonate) into tricalcium phosphate, whereupon the whole mixture is heated to a temperature of at least about 1300° C., and preferably to about 1350° C.

According to a modification of the invention such phosphates as are capable of combining with the whole, or at least the greater part, of the lime other than that already combined with phosphoric acid as tricalcium phosphate, can be used instead of phosphoric acid. When employing an alkali metal phosphate for this purpose, the reaction would proceed e. g. in accordance with the equations:

I. $3CaF_2+2Na_3PO_4=Ca_3(PO_4)_2+6NaF$
II. $3CaCO_3+2Na_3PO_4=Ca_3(PO_4)_2+3Na_2O+3CO_2$.

These equations are based on the employment of orthophosphates; however pyrophosphates or metaphosphates may be used instead. In this case it has moreover been observed that the alkali content of the alkali metal phosphate has an effect similar to that of phosphoric acid, so that according to this modification of the invention it is not only possible to replace the phosphoric acid as such by phosphoric acid in a combined form which is cheaper, but also to effect a saving in total amount of phosphoric acid (whether uncombined or combined) as such.

Similarly, when operating with phosphoric acid or with phosphoric acid compounds other than alkali metal phosphates, a further saving in phosphoric acid (both combined or uncombined) can be effected by providing a further addition of alkali, e. g. in the form of soda ash, sodium sulphate, potash, or potassium sulphate. In this respect it has been found advantageous to provide about 0.5 mols of alkali oxide for every mol of P_2O_5 contained in the raw phosphate.

When adding alkali to the reaction mixture and particularly when such alkali is added in the form of alkali metal phosphate, it has been observed that decomposition of the raw phosphates already takes place with lower heating temperatures, viz. at least about 1100° C., and preferably about 1250 to 1280° C.

Whilst when using phosphoric acid alone for the decomposition, a high silica content of the raw phosphate is somewhat troublesome, this is not the case when an addition of alkali is made to the reaction mixture; in the latter case a relatively high silica content of the raw phosphate is indeed desirable. The treatment with phosphoric acid alone is however also applicable to raw phosphates rich in silica provided that lime is added to the reaction mixture in such quantities that the silica present is converted thereby into calcium silicates. Frequently however, it is more advantageous to make up a burden in which raw phosphates rich in silica (e. g. Pebble phosphate) are mixed with raw phosphates poor in silica (e. g. Morocco phosphates), since with a medium silica content (i. e. a content not exceeding about 4% SiO_2 in the raw phosphates) the decomposition with phosphoric acid alone leads to satisfactory results.

Moreover it is sometimes also advantageous to provide for a special addition of silica (sand) when treating raw phosphates poor in silica with phosphoric acid and alkali since, as has already been stated, the presence of silica promotes the decomposition in the presence of alkali. When the treatment is carried out with phosphoric acid alone, then the silica content of the raw phosphate must be at least about 3% in order to arrive at a product of satisfactory solubility. If the silica content of the phosphate is less, then a corresponding amount of silica must be added to the reaction mixture.

Examples

The finely ground raw phosphate is, after careful admixture of any solid additional ingredients (alkali metal compounds, lime, silica etc.), moistened with water or phosphoric acid, as the case may be, and granulated by means of a worm conveyor. The granules which preferably have an average diameter of 2–6 mms. are continuously supplied to a rotary furnace in which a temperature of 1400° C. or 1280° C., respectively, is maintained at the end where the flame enters, according to whether phosphoric acid alone, or jointly with alkali, is used for decomposition. The small granules maintain their shape during the heating process, are hard and porous and easily crushed.

1. To 25 kgs. of Pebble phosphate (32% P_2O_5, 47, 6% CaO) are added 2,3 kgs. P_2O_5 in the form of aqueous phosphoric acid (350 g P_2O_5 per litre) and 1,5 kgs. of lime (CaO). The final product contains:

Total P_2O_5: 38,28%
P_2O_5 soluble in citric acid:
36,38%=95% of the total P_2O_5 concentration
P_2O_5 soluble in ammonium citrate solution:
28,54%=74,5% of the total P_2O_5 concentration
F: 0.06%

2. To 50 kgs. Pebble phosphate (32.0% P_2O_5, 47.6% CaO) are added 7,50 kgs. of soda and 2.50 kgs. P_2O_5 in the form of aqueous phosphoric acid (350 g P_2O_5 per litre). The final product contains:

Total P_2O_5: 36.00%
P_2O_5 soluble in citric acid:
35.80%=99.4% of the total P_2O_5 concentration
P_2O_5 soluble in ammonium citrate solution:
34,72%=96.5% of the total P_2O_5 concentration
F: 0.05%

3. To 25 kgs. of Pebble phosphate (32.0% P_2O_5, 47.6% CaO) and 25 kgs. of Morocco phosphate (34.2% P_2O_5, 49,64% CaO) are added 8.0 kgs. of soda and 3.0 kgs. P_2O_5 in the form of aqueous phosphoric acid. The final product contains:

Total P_2O_5: 37.41%
P_2O_5 soluble in citric acid:
35.98%=96.2% of the total P_2O_5 concentration
P_2O_5 soluble in ammonium citrate solution:
35.30%=94.3% of the total P_2O_5 concentration
F: 0.09%

4. To 25 kgs. of Pebble phosphate (32.0% P_2O_5, 47.6% CaO) are added 3.94 kgs. $Na_4P_2O_7.10H_2O$ and 1.60 kgs. of soda. The final product contains:

Total P_2O_5: 36.85%
P_2O_5 soluble in citric acid:
35.40%=96.0% of the total P_2O_5 concentration
P_2O_5 soluble in ammonium citrate solution:
34.82%=94.4% of the total P_2O_5 concentration
F: 0.12%

5. To 25 kgs. of Pebble phosphate (32% P_2O_5, 47.6% CaO) are added 2.4 kgs. $CaHPO_4$ and 2.2 kgs. $Ca(H_2PO_4)_2$. The final product contains:

Total P_2O_5: 38.35%
P_2O_5 soluble in citric acid:
36.38%=95% of the total P_2O_5 concentration
P_2O_5 soluble in ammonium citrate solution:
28.54%=74.5% of the total P_2O_5 concentration
F: 0.05%

6. To 25 kgs. Morocco phosphate (34.2% P_2O_5, 47.6% CaO) are added 4.1 kgs. soda, 1.25 kgs. P_2O_5 in the form of aqueous phosphoric acid and 0.75 kg. SiO_2 (sand). The final product contains:

Total P_2O_5: 37.79%
P_2O_5 soluble in citric acid:
37.39%=99% of the total P_2O_5 concentration
P_2O_5 soluble in ammonium citrate solution:
36.21%=95.8% of the total P_2O_5 concentration
F: 0.15%.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRELIMINARY TREATMENT OF WOOD

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Application filed June 27, 1939

It is known to compress wood, particularly wooden veneers, in order to vary its mechanical properties, such for example as its power of resistance to fracture, its superficial hardness or the like so as to improve these properties. This compression is frequently carried out at a high temperature, after previously steaming the wood or with the help of other measures such as the use of binding agents for example.

The present invention relates to a preliminary treatment of wood, which likewise makes use of compression, but does not aim at any consolidation of the wood, on the contrary its aim is to act upon its cellular structure only transitorily. The treatment of wood according to the present invention consists in compressing the wood in large pieces of rough form such as cuttings from tree trunks, logs or billets, sticks, rolls, etc., the wood being compressed transversely to the direction of the fibres to a fractional part of its volume. This process is intended to be used in particular for wood the cellular structure of which is to be subsequently opened up for the purpose of manufacturing paper, cellulose and the like therefrom, and can therefore serve as a preliminary stage in the usual process of opening it up, e. g., the boiling process.

The result of the application of the process according to the present invention is a double one. By the compression of the cut up wood without any additional treatment, a considerable saving is obtained in space required for transport particularly in the case of woods of light weight in proportion to their volume. The invention therefore provides a decisive means of importing overseas woods, such as elk tree wood or the like, the cost of freight for which is otherwise intolerable.

The charging of the boilers in which the wood is boiled for the manufacture of paper and other disintegrating operations carried out can be considerably increased by the use of the present invention, so that the expenditure of liquor or lye and the cost of heating, etc., is rendered particularly economical.

The invention is however as experiments have shown of special advantage in that the compressed wood possesses an astounding power of rapidly absorbing into itself a considerable amount of liquid and swelling up in doing so very nearly to its original volume, the liquid moreover not only penetrating into the marginal zones of the wood but saturating it completely.

In this way the process according to the present invention is of extraordinary importance as a preliminary treatment of woods previous to a disintegrating process, as it renders possible a hitherto unknown intensive and rapid penetration of the liquor or lye into the wood, thereby shortening the time required for boiling and also ensuring a uniform opening up of the fibrous structure of the wood whilst being boiled, without the undesirable formation of zones which, in the known processes frequently leads to the destruction of the outer layers of the fibres, before the inner parts of the wood have been properly opened up. By means of the present invention therefore the total yield of cellulose, in proportion to the dry substance of the boiler wood, can be considerably increased, as there are no parts which have been opened up too much and which otherwise yield fibrous materials which are quite unusable or are of inferior quality.

The surprising degree in which the process according to the present invention increases the power of wood to absorb liquids is shown in the accompany Fig. 1 by a diagram which reproduces the results of comparative tests.

Of two equal squared pieces of elk tree wood (Musanga Smithii) of the same natural weight in proportion to their volume one was laid in water untreated and the other after having been compressed to one fourth of its volume. The abscissae of the diagram give the time of immersion in hours while the ordinates show on the one hand the increase in weight (absorption of water) in grams and on the other hand the increase in volume in millimetres. The curves drawn in solid lines relate to the absorption of water, those drawn in dotted lines to the increase in volume.

The untreated sample of wood I had accordingly absorbed only 50% of its weight of water in 24 hours, while its volume had risen by about 2%. The pressed sample II had absorbed even after 1½ hours 500% of its weight in water, its original volume having almost been restored, notwithstanding the great pressure to which it had been subjected.

Fig. 1 shows the special importance of the idea on which this invention is based, at once. The pressing of the wood not only effects the above mentioned economical and decisive cheapening of the transport thereof, but also makes it possible, in a manner which has been hitherto entirely unknown, for the wood to absorb the liquor or lye in a surprisingly rapid and complete manner into its innermost zones whilst being opened up.

Fig. 1 also shows that according to the subsequent use to which the wood was to be put, that

it would also be imaginable to press light wood at the place where it was felled and cut up and then to convey it to some place oversea where it could be treated and finally bring it to substantially its original volume again by absorption of water, after which it could be dried by one of the usual processes, e. g., heating, vacuum or the like and mechanically worked up in the form of pieces.

The pressure under which the process according to the present invention is to be carried out, may vary according to the kind of wood treated, the degree of compression necessary and the behaviour of the wood desired after pressing.

Specific pressures of about 100 to 150 atmospheres above atmospheric pressure under which the wood is compressed to about one fourth of its original volume may however be used with particular advantage. The accompanying Fig. 2 shows this by means of curves the abscissae of which indicate the reduction in volume and the ordinates the specific pressure. Curve I shows the maximum compression of regular experimental bodies of elk tree woods, curve II shows the re-expansion which takes place after the pressure has been taken off and curve III the permanent reduction in the volume of the wood.

From Fig. 2 it can be seen that above 150 atmospheres above atmospheric pressure only a compression which takes place substantially asymptotically ensues, whereas below about 100 atmospheres above atmospheric pressure the permanent elastic part is too great for the normal case.

In all cases it is advisable, in view of the possible premature reexpansion of the pressed wood, particularly when it is intended for prolonged transport, to provide the bundles of pressed wood with a binding material which does not expand, e. g., iron bands.

To carry out the process according to the present invention any desired kind of press, such as a hydraulic press for example, may be used, which may be stationary or capable of being moved about from place to place. The latter type of press, which may be driven by the engine of a tractor for example, has the advantage that it can be erected at the place where the wood is cut.

Investigation of the pressing operation shows that in the first part of it, which extends to about two-thirds of the stroke of the ram, really only a closer piling up and initial consolidation of the separate pieces of wood takes place, and that accordingly the ram of the press can be moved comparatively rapidly and with but a slight expenditure of force during this part of the operation. In the second part of the pressing operation however it is necessary to allow the ram to act more slowly and to work the press at a higher pressure. For this reason it is preferable to use a press which works in two or more stages, and the stages can be arranged to come into action automatically.

In view of the fact that the logs of wood or the like must all be arranged in layers in a definite direction when being pressed, it is preferably to use a horizontal press with a horizontally working ram. In Fig. 3 is shown a vertical section and in Fig. 4 a horizontal section through a diagrammatic construction of a press such as should be used for carrying out the process according to the present invention. 5 denotes here for example a hydraulically controlled press ram, which is moved horizontally in a press cylinder 6. The press cylinder 6 is preferably so constructed that both the upper wall 7 and also the back wall 8 can be removed, i. e., swung aside or lifted off. After removing the top cover the wood can then be placed in the cylinder of the press from above as shown in Fig. 4, while after the conclusion of the pressing operation and after the removal of the back cover 8 the compressed bundle of wood can be expelled by the ram.

Instead of the top cover of the press being made removable one side wall thereof may naturally be made capable of removal, so that the wood can be packed in layers into the cylinder from the side thereof.

The principal reason why the wood is used in the form of rough pieces in this operation is that its fibres can be easily arranged transversely to the direction in which the ram of the press moves. Experiments have shown that when wood is pressed in the direction in which the fibres run the object aimed at by the present invention cannot be attained, particularly for the reason that the fibres of the wood are crumpled up and burst. If therefore the wood were to be pressed in a finely subdivided form, say in the form of chips for example, uniform alignment of the fibres transversely to the direction in which the ram of the press moves would be impossible or at least uneconomical.

Figs. 3 and 4 show simultaneously an arrangement which makes it possible to bundle the pressed wood in a convenient and reliable manner. For this purpose there are provided in opposite walls 10 and 11 of the press cylinder one or more parallel grooves 12, 13 which run parallel with the direction of the pressure and in which before the cylinder of the press is filled, strips of iron band or the like can be laid in the form of U-shaped stirrups or yokes which are open towards the removable back cover 8 of the press and are of a suitable length of limb. The free ends of these stirrups or yokes 14 are forced as the ram of the press moves forwards through guides 15, 16 in the bottom cover 8 in an outward direction and after the bottom cover of the press has been removed previous to the expulsion of the pressed bundle of wood are connected to each other in any suitable manner.

It is of course possible to bundle the wood in other ways as for example by adding to the press cylinder instead of the bottom cover 8 an apparatus by which the pressed wood is pushed against a band which can be unwound from a stock roll and which after the wood has been completely expelled from the cylinder of the press can be closed on the side of the wood next to the ram.

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PUBLISHED

MAY 4, 1943.

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PROCESS FOR THE PRELIMINARY TREATMENT OF WOOD

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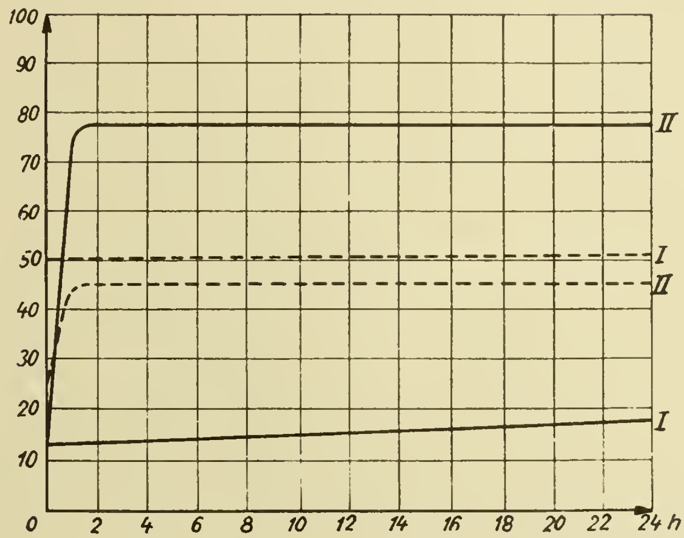
2 Sheets-Sheet 1

Fig. 1



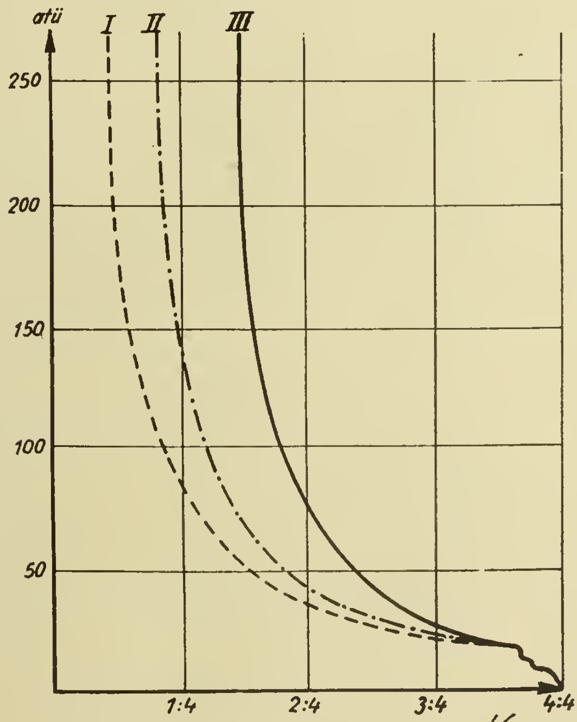


Fig. 2

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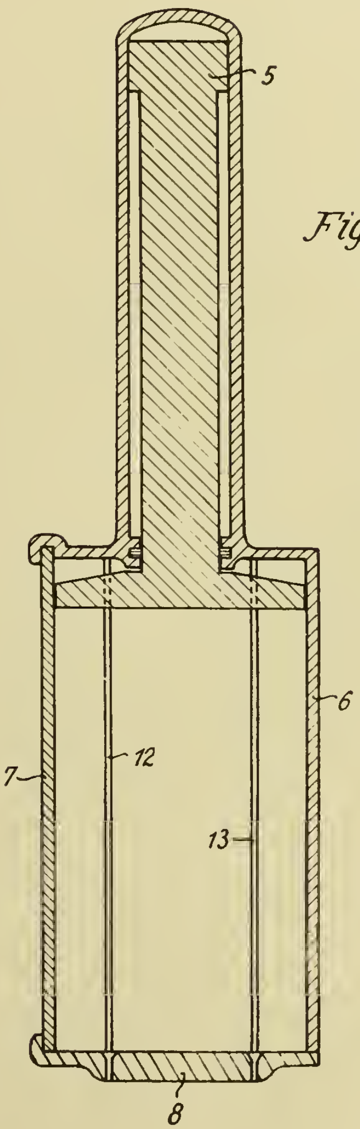

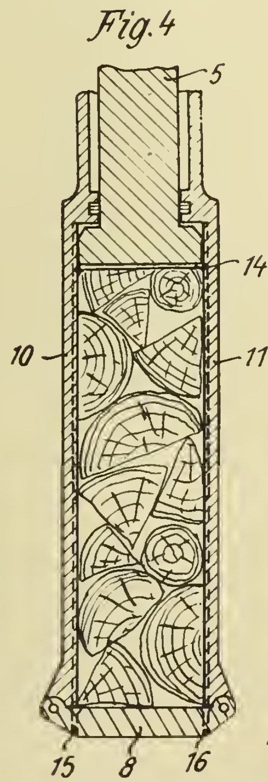

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ALIEN PROPERTY CUSTODIAN

SHIFT CONTROL MECHANISM FOR GEAR TRANSMISSIONS

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Application filed June 30, 1939

This invention relates to multiple speed gear transmissions as used in motor vehicles and wherein the setting of at least certain speed selections necessitates the shifting of a plurality of pairs of gears. The essential object of the invention is to provide a control mechanism which will prevent the setting of the different pairs of gears simultaneously, and which will insure successive operation such that the shifting of one pair of gears into engagement will not begin until after another pair of gears involved in the shift to produce the same speed selection has been fully engaged.

It has heretofore been proposed to use power operated gear shifting means for gear transmissions. Usually such mechanism involves a plurality of shifting motors operative each to effect engagement and disengagement of certain sets of gears of the transmission so that in cooperation with each other the several motors produce any speed selection of which the transmission is capable. The motors are usually of a fluid pressure type, operating either under positive pressure or partial vacuum, but in some instances the motors may be of a mechanical or electrical type.

The present invention is particularly designed to control the power of the several shift motors of a gear shifting mechanism so that they will operate in successive timed relation with respect to one another. One motor is caused to shift the pairs of gears which it controls, in some instances into engagement and in other instances away from engagement, before the other motor becomes operative to shift other sets of gears.

In order to speed up the shifting of gears in the transmission from one speed selection to another, it has heretofore been proposed to provide in association with the shift mechanism proper auxiliary devices for bringing parts of the transmission to be engaged which are rotating at considerably different speeds, due to the different gear ratios in the transmission, to substantially the same speed at which they can be engaged. In certain instances faster moving transmission parts must be retarded so that they may be engaged with originally slower moving parts, and for this purpose it has been proposed to use a retarding mechanism in the form of a braking device. In other instances, it is necessary to speed up an originally slower moving part of the transmission to hasten engagement with a faster moving part. Various forms of accelerating devices for this purpose have been proposed. One type of such mechanism involves an arrangement by which during the course of the shifting operation the vehicle clutch is momentarily engaged and the vehicle engine speeded up so as to increase the speed of slower moving parts of the transmission.

The present invention is useful in connection with gear shift mechanisms wherein auxiliary devces of the character mentioned are employed in association with the shift mechanism proper. Furthermore, it is contemplated according to the invention that the control mechanism through which the different shift motors are caused to operate successively may operate in dependency on the auxiliary retarding and/or accelerating devices.

While it is believed that the invention is new in its basic features, it is to be noted that the design of the control mechanism is important in securing most successful operation. It is a further feature of the invention to provide a control mechanism of the type described which has particular operating advantages for reasons which will hereafter fully appear.

According to the invention the control mechanism includes a plurality of control members for different gear pairs of the transmission, which members are arranged in two groups. One group will serve to control one set of transmission parts which are to be brought into engagement, and the other group of control members will serve to control other gear parts when they are to be engaged. Preferably one group will control those gear parts which require retardation in order to be engaged with coacting parts, and the other group of control members will preferably control the parts which require speeding up in order to be engaged with coacting parts.

The gear shifting operation will be initiated ordinarily through a manually controlled speed selecting lever which will set the proper control members necessary to result in the proper setting of gears for a particular speed selection. Auxiliary control means is provided in association with the several groups of control members so that not only will the several gear shifting motors be caused to operate in the proper directions to produce the desired gear selection, but also the power will be supplied to the several motors in proper timed relation so that they will not operate simultaneously.

The subject-matter of the invention is illustrated in the accompanying drawings wherein:

Fig. 1 is an assembly view, more or less diagrammatic, of a fragmentary portion of a multiple speed gear transmission of the type involving constantly meshing gear pairs which are ren-

dered operative and inoperative through claw clutches, and showing further vacuum operated gear shifting motors and the control mechanism therefor;

Fig. 2 is a horizontal section, looking down, of the control mechanism shown in Fig. 1; and

Fig. 3 is a sectional elevation of a modified form of control mechanism.

In Fig. 1 the drive shaft of the change speed gear transmission is designated 1. The main shaft train includes gears 2, 3 and 4 and the counter shaft train gears 5, 6 and 7. The freely rotatable gear pair 3 and 6 are connected to gears 2 or 4 or 5 or 7, respectively, by means of the movable jaw clutch members 8, 9, 10 and 11 meshing with the jaw clutch portions 8′, 9′, 10′ and 11′. The clutch members 8 and 10 are moved alternately by the lever 12 and the clutch members 9 and 11 by the lever 13. The lever 12 is connected to the rod 14 of the shifting piston 16. 18 is the shifting cylinder with the extension bore 20. 22 and 24 are grooves in the piston rod 14, 26 a vent in the bore 20. The lever 13 is connected to the rod 15 of the shift piston 17. The corresponding shift cylinder is marked 19 and is provided with an extension bore 21. 23 and 25 are grooves in the piston rod 15.

Each group of control members is connected to a source of auxiliary power and each contains a closing member which prevents simultaneous operation of retarded and accelerated shifts. The closing member which prevents simultaneous operation of retarded and accelerated shifts is made dependent on the shift position of the parts to be connected. For this purpose the closing member may be made dependent on an auxiliary device which serves to accelerate the shifting operation and the auxiliary device in turn is made dependent on the parts to be connected. Preferably the closing member is actuated by the same pressure medium which is effective in the auxiliary device to accelerate the shift. The pressure medium is controlled by the rods of the shifting pistons in known manner.

The operation of the closing member can be effected in such a manner that it is closed by the pressure acting on the auxiliary accelerating device and is opened by the shift pressure. By auxiliary pressure is understood the pressure which is effective in an auxiliary device which serves to accelerate the shift. Shift pressure is the pressure which is effective on the shift pistons and which serves to shift the various gear pairs.

A housing is marked 30 and contains on the one side in one group the control members 31, 33, 35 and opposite them a second group of control members 32, 34, 36. These control members are mounted in the chambers 51 to 56 by means of the springs 41 to 46. 37, 38 and 39 are moving and closing members for the control members 31 to 36 which are provided with central bores 31′ to 36′. One of the moving and closing members 37, 38 and 39 lies between each pair of control members 31 and 32, 33 and 34, and 35 and 36. The manually operated gear shift lever 60 moves these moving and closing members into the positions corresponding to the desired gear selection through cam discs 67, 68 and 69 which operate on the levers 47, 48 and 49 journaled on a common shaft 50, and move them, and hence the moving and closing members, against the pull of the springs 57, 58 and 59. As a result the corresponding control members are brought into position.

70 is the intake manifold with a partial vacuum line 71 which carries shift pressure and contains the valve box 72. 73 is an operating knob which is moved by the crank 74, 75. In the example shown 75 is the clutch pedal. In principle any special lever may replace the clutch pedal.

76 is a tension spring for the clutch pedal 75, 77 and 78 are stops for the same pedal. The line 71 opens into the chamber 80. 81 is a further line which opens into the chamber 63. The left chamber 63 is connected to the further chambers 51, 53, 55 whose closing members 31, 33, 35 are lifted by the moving or closing members 37, 38 or 39. 82 is a branch line for the chamber 64 on the opposite side. The right chamber 64 is connected to the chambers 52, 54, 56 by lifting the corresponding control members 32, 34, 36. 61 is a chamber, vented to the atmosphere through the vent 62, in which the control members 31 to 36 open. The closing member 90 is arranged in the chamber 89 and is connected to the piston 92 through the shaft 91, the piston moving in the chamber 93 and being loaded by the spring 94. 95 is a vent. 101, 103, 105 are pressure lines which depend on the left group of control members 31, 33, 35 acting as an accelerating group. 102, 104, 106 are dependent on the control members 32, 34, 36 at the right forming a retarding group. In Fig. 1 a part only of the gear transmission is shown with the two shifting cylinders 18 and 19 in order to simplify matters. The line 101 opens at the left of left shift cylinder 18 and the line 102 at the right while line 103 opens at the right of right cylinder 19 and line 104 at the left. The connections for the lines 105 and 106 indicated in Fig. 2 are intended for a third shift cylinder and hence are not further illustrated. The line 120 branches off from the intake manifold 70 and carries auxiliary pressure, opening into the extension bore 20 of the cylinder 18. A branch 121 of this line also opens into the extension bore 21 of the cylinder 19. 122 is a further line which connects the two bores 20 and 21 and is connected to the line 123 which opens into the cylinder 124 of the auxiliary device 125 designed as a brake for accelerating the shift. The line 126 branches from the line 123 carrying auxiliary pressure to chamber 93.

Assuming that the gearing has been operating at a speed selection in which jaw clutches 8, 8′ and 11, 11′ are disengaged, and jaw clutches 9, 9′ and 10, 10′ engaged, the gear selection represented in Fig. 1 is obtained as follows: The control members 31 to 34 are brought into the position shown in Fig. 2 by pushing the control member 32 into its right hand position by means of the moving and closing member 37. Partial vacuum from line 82 reaches the chamber 52 and from there through the line 102 into the chamber to the right of the piston 16 of the left shift motor while at the same time atmospheric pressure entering through casing vent 62 flows through the bore 31′ of the control member 31 into the chamber 51 and thence through the line 101 into the chamber to the left of the piston 16 of the left shift motor. As a result piston 16 moves to its right end position and the clutch member 8 engages with the jaw member 8′ of the gear 3. The movement of the control member 33 into its left position causes partial vacuum to reach through the chamber 53 and the line 103 to the right of the piston 17 and atmospheric pressure reaches to the space to the left of piston 17 through the bore 34′ of the control member 34, the chamber 54 and the line 104. The pis-

ton 17 is moved into its extreme right hand position and hence the clutch member 11 meshes with the jaws 11' of the gear 6. A further shifting cylinder is controlled in an analogous manner by the control members 35 and 36.

A new gear is to be chosen in which both the piston 16 and the piston 17 are moved from their right hand position as shown into their left hand position whereby the clutch 9 engages the jaws 9' of the gear 3 and the clutch 10 engages the jaws 10' of the gear 6. The gear shift lever 60 moves the moving and closing member 37 to the left thus closing the bore 31' of the control member 31 from the atmosphere, this member is lifted against the pressure of the spring 41 and thereby the line 81 is connected to the line 101 through the chamber 63 and the chamber 51. The control member 32 is pressed back into its left hand position by the spring 42, cuts off the connection between the chamber 64 and the chamber 42 and at the same time connects the latter to the chamber 61 through the bore 32' which is vented to atmosphere through the vent 62. The moving and closing member 38 is moved to the right, closes the bore 34' of the control member 34, moves the latter to the right against the pressure of the spring 44 and connects the line 82 to the line 104 through the chamber 64 and the chamber 54. The control member 33 is moved to the right by the spring 43, breaks the connection between the chamber 63 and the chamber 53 and connects the chamber 53 to the atmosphere through the bore 33' and the chamber 61.

When the driver throws out the clutch by pressing down the pedal 75 and at the same time moves the operating knob 73 through the crank 74 the partial vacuum of the intake manifold 70 is connected to the line 71. This can be done in known manner either by operating a simple valve setting free the shifting pressure or the movement of the knob 73 may set free the shifting pressure by the interconnection of a relay device.

After setting free the shift pressure this reaches on the one hand the chamber 80 and on the other hand through the line 82 the chamber 64. The design (chamber size, throttling) is so chosen that the partial vacuum from line 82 becomes effective in the right chamber 64 before partial vacuum from chamber 80 and line 81 become effective in left chamber 63. From the chamber 64 the shift pressure reaches the space to the left of the piston 17 through the opened control member 34, the chamber 54 and the line 104 while at the same time the space on the right of the piston 17 is connected to atmosphere through the line 103, the chamber 53, the bore 33' of the control member 33, the chamber 61 and the vent 62. The end positions of the pistons 16 and 17 are marked B and V respectively, the movement to the position B representing an accelerated shift and that to the position V a retarded shift. Thus movement of piston 16 of of the left shift motor to its left end position, and movement of piston 17 of the right shift motor to its right end position represent an accelerated shift. Conversely, movement of piston 16 to its right end position, and movement of piston 17 to its left end position represent a retarded shift.

Under the action of the partial vacuum the piston 17 moves to the left, the clutch member 11 is disconnected from the jaws 11' and after moving through a neutral position the clutch member 9 meshes with the jaws 9' of the gear 3. In order to bring the clutch member 9 into mesh with member 9', the latter member, which is connected to the driving side, must be retarded because the clutch member 9 is turning more slowly. In this position the piston 17 has moved to the left far enough so that the opening of the line 121 is connected through the groove 25 of the piston rod 15 to the opening of the line 122. Therefore, partial vacuum from the intake manifold 70 reaches through the line 120 and the line 121 to the groove 25 in the line 122. From this line the partial vacuum acting as auxiliary pressure flows through the line 123 to the cylinder 124 of the braking device 125. At the same time this pressure reaches the chamber 93 above the piston 92 through the line 126 which branches off from line 123. The piston 92 is raised against the pressure of the spring 94 so that the closing member 90 is forced against its seat by the shaft 91 and chamber 80 is disconnected from the line 81. No shifting pressure therefore can reach the control member group 31, 33, 35 by means of which accelerated shifts are effected.

As soon as the r. p. m. of the jaws 9' on the gear 3 has been sufficiently reduced so that clutch members 9 and 9' rotate at substantially the same speed, meshing thereof takes place in known manner as a result of the beveled faces of the teeth.

As meshing of the clutch halves 9, 9' is completed the piston 17 of the right shift motor reaches its left end position V under the operation of the shifting pressure which is continuously supplied through the line 104. By this means finally the opening of the line 122 is closed from the line 121 by the portion of the rod 15 lying between the grooves 25 and 23 and is connected through the groove 23 to the line 127. This in turn is connected through the groove 24 of the piston rod 14 and the vent 26 to the atmosphere. In this manner both the lines 123 and 126 are vented so that on the one hand the braking action of the auxiliary device 125 stops and on the other hand the piston 92 is moved by the spring 94 back into its lower position and the closing member 90 lifted from its seat. The shifting pressure now reaches to the line 81, thence through the chamber 63 and the opened control member 31 into the chamber 51 and through the line 101 to the chamber at the left of the piston 16. As a result the piston 16 of the left shift motor moves to the left, the clutch member 8 is moved out of mesh with the jaws 8' of the gear 3 and the clutch member 10 is moved against the jaws 10' of the gear 6. Meshing of the clutch portions 10 and 10' requires an acceleration of the clutch half 10 which can be effected either manually by the driver or by means of a special shift auxiliary mechanism of known design. At the instant of overtaking the clutch halves 10 and 10' mesh in known manner and the piston 16 moves into its left end position B.

When the piston 16 is to be moved from its left end position B to the right end position V shown in Fig. 1, that is to say when a retarded shift is to be effected, this is accomplished in a manner analogous to that which was described for the movement of the piston 17 from its right to its left end position in which the clutch halves 8 and 8' just strike each other. The auxiliary pressure passes through the groove 22 from the line 120 into the line 122 and through the line 123 to the brake cylinder 124 and also through the line 126 to the chamber 93 above the piston

92, thus causing the closing member 90 to close and preventing the operation of an accelerated shift while the retarded shift is taking place.

The control of the braking device 125 during a retarded shift by the grooves 22 and 25 in the piston rods 14 and 15, which at the same time prevent an initiation of an accelerated shift, has no effect during the movement of the piston 16 from its right position into its left end position B or the movement of the piston 17 from its left into its right end position B, that is to say in an accelerated shift, because on disengagement of the corresponding connection the control path is very rapidly traversed. Hence no material lowering of pressure takes place either in the line 123 or the brake cylinder 124, or in the chamber 93.

The control mechanism is also effective in fundamentally the same manner if both a member of the clutch members 8 or 10 and also one of the clutch members 9 or 11 are disengaged simultaneously and one each of the clutch members is just ready to engage. If for example on the one hand the clutch half 8 and on the other hand the clutch half 11 are about to mesh, the line 120 is connected to the line 122 through the groove 22. As a result, as described above, the retarding device 125 becomes active and the closing member 90 is closed. The operation of the braking device 125 retards the clutch member 8 so that this finally meshes with the jaws 8'. Thereafter the clutch member 11 can mesh with the jaws 11' by increasing the r. p. m. of the jaws 11' by opening the throttle or by an auxiliary accelerating device until the meshing r. p. m. is reached.

If the clutch members 10 and 11 are disengaged simultaneously and the clutch members 8 and 9 are about to mesh with the jaws 8' and 9', involving two retarded shifts, the line 122 is connected to the line 120 not only through the groove 22 but also through the groove 25 to the line 121. Partial vacuum is led to the braking device 124, 125 through both controls. In this manner after the r. p. m. of the clutch 8 has reached the meshing r. p. m. and the two clutch halves have meshed the r. p. m. of the clutch half 9' is still further lowered until this meshes with the clutch 9.

If in such a case, that is to say when both clutch members 8 and 9 are about to mesh, the r. p. m. of the free gear pair 3, 6 drops more rapidly than the r. p. m. of the clutch half 8 which is to mesh by reason of the braking device 124, 125, which result can take place by reason of the small mass of the gear pair or lubricant friction, the clutch half 9' will first mesh with the clutch half 9, thereafter the r. p. m. of the clutch 8 will be further decreased by the brake until meshing r. p. m. is reached and the clutch half 8 meshes with the jaws 8'. Naturally all of this occurs very quickly.

The device described through very simple mechanism prevents the start of accelerated shifts as long as any retarded shifts have not been completed. The device can be used in fundamentally the same manner with transmissions having a different type of gear shift elements than the jaw clutches shown.

The modification of the invention of Fig. 3 involves a particular design of closing member and its actuation. In accordance with the invention the closing member is held closed by a spring; furthermore one side of the operating member for the closing member is exposed to the auxiliary pressure whereas the other side is connected to a chamber to which shift pressure is led with retardation. The forces acting on the closing member by reason of the spring and the two pressure media are so adjusted that on the one hand the closing member is held closed by the auxiliary pressure against the action of the shift pressure, whereas on the other hand when the auxiliary pressure is removed the closing member is opened by the shift pressure against the force of the spring.

In Fig. 3 the shift pressure line 71 opens into the chamber 140 to which is connected the line 82 for the retarding group of control members 32, 34, 36. The chamber 140 is closed off from the chamber 141 by the closing member 90 which is under the pressure of the spring 94 through the piston 92 and the shaft 91. The line 81 for the accelerating group of control members 31, 33, 35 connects to the chamber 141. To the right of the piston 92 is the chamber 143 in which opens the line 126 which can supply auxiliary pressure from the line 123. To the left of the piston 92 there is the chamber 144 in which delayed shifting pressure flows from the chamber 140 through the bore 145. 146 is a throttling portion in the bore 145.

The operation of the particular design of closing member shown in Fig. 3 is as follows: Immediately after initiating flow of the shift pressure at the valve box 72 shift pressure passes through the line 71 into the chamber 140 and from there through the line 82 into the chamber 64 and, depending on the position of the control members 32, 34, 36 for retarded shifts, reaches line 120, 104, or 106 and thence the corresponding gear shifting cylinders.

The spring 94 holds the closing member 90 in its right hand position and closes off chamber 140 from chamber 141. Therefore after the shifting pressure is set free no shift pressure reaches the control members 31, 33, 35 and hence no accelerated shift can be initiated. In the mean time shift pressure slowly flows through the throttling orifice 146 and the bore 145 into the chamber 144. At the same time the retarded shifts which are already proceeding carry auxiliary pressure through the line 120 or 121, through the corresponding grooves in the piston rods 14 or 15, into the line 122 and the line 123, and thence into the line 126 into the chamber 143. The auxiliary pressure operates to hold the closing member 90 against its seat. If after a while pressure is equalized in chambers 140 and 144 through the bore 145, the closing member 90 still remains closed as it is pressed by the combined action of the spring 94 and the auxiliary pressure existing in the chamber 143, which overbalance the shift pressure operating on the left side of the piston 92. When the retarded shifts are completed and the auxiliary pressure disappears from the lines 123, 126 and 143, the shift pressure on the left side of the piston 92 exceeds the pressure of the spring 94 and the partial vacuum on the right side of the closing member 90. As a result the closing member 90 is opened, and shift pressure flows from chamber 140 to chamber 141 and through line 81 to the accelerated shift.

The device according to Fig. 3 operates as follows in the various possible shift cases:

(*a*) If both retarded and accelerated shifts are necessary for the gear chosen the retarded shifts are initiated immediately and the accelerated shifts can only proceed when the auxiliary pressure has disappeared from the chamber 143 and

the closing member 90 is opened by the shift pressure which has in the meantime become effective in the chamber 144.

(b) When only retarded shifts are necessary these proceed without further ado. The fact that thereafter the closing member 90 is open and shift pressure reaches the line 81 has no effect since no accelerated shifts are chosen.

(c) When only accelerated shifts are demanded there is only a slight delay because the closing member 90 is rapidly opened since there is no auxiliary pressure in the line 123 and hence in the chamber 143 by reason of the absence of the retarded shifts.

It will be evident to those skilled in the art that the control mechanism of the invention provides an efficient arrangement for improving shifting in multiple speed gear transmissions wherein the setting of a designated speed selection necessitates shifting of a plurality of transmission parts. By preventing more than one shift occurring at one time, interference will be avoided. Also the invention enables auxiliary shifting devices, for speeding up slower parts and retarding faster parts to be engaged with other parts in quickly attaining completion of the shift operation, to operate efficiently. The basic features of the invention can be incorporated in other forms than here illustrated, and may be employed with gear shifting motors and with multiple speed gear transmissions other than those shown. Accordingly, the scope of the invention is to be determined in accordance with the appended claims.

GUSTAV MEYER.

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MAY 4, 1943.

BY A. P. C.

G. MEYER
SHIFT CONTROL MECHANISM FOR
GEAR TRANSMISSIONS
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Serial No.
282,309

2 Sheets-Sheet 1

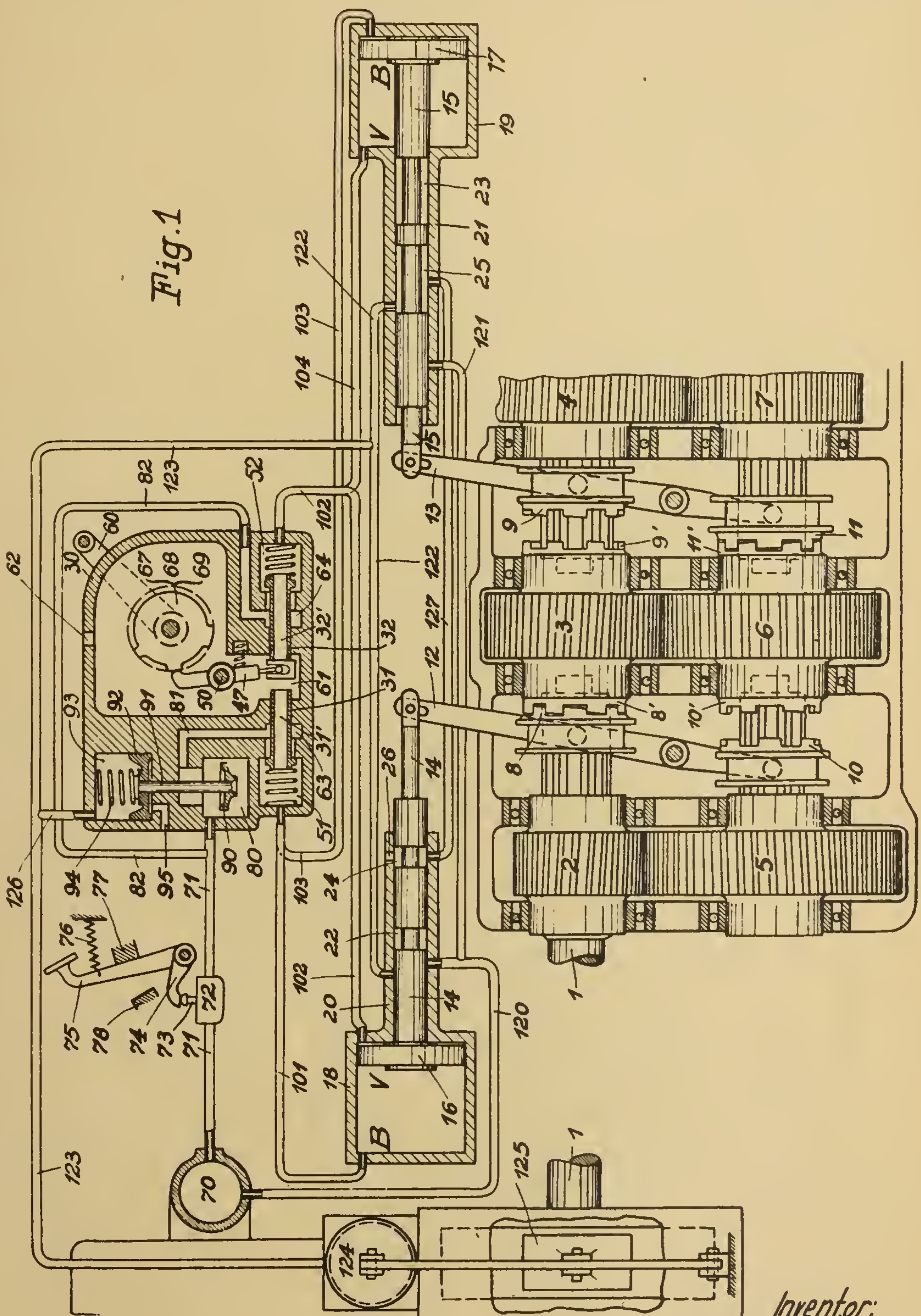

Fig.1

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2 Sheets-Sheet 2

Fig. 2

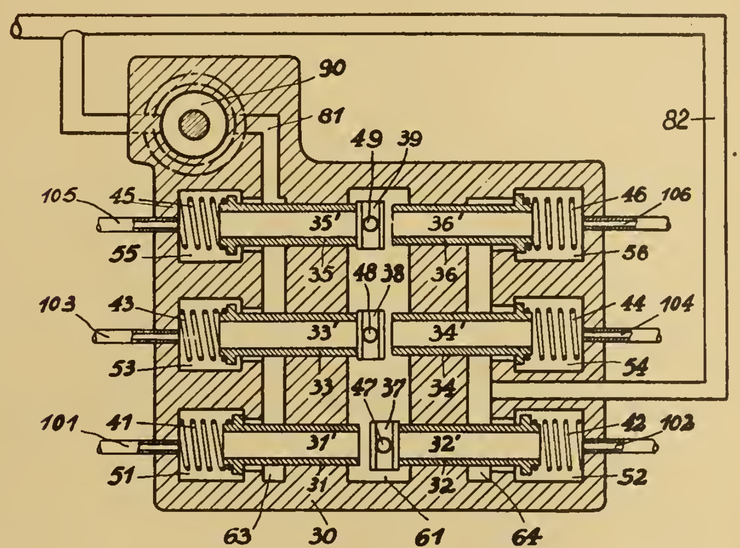
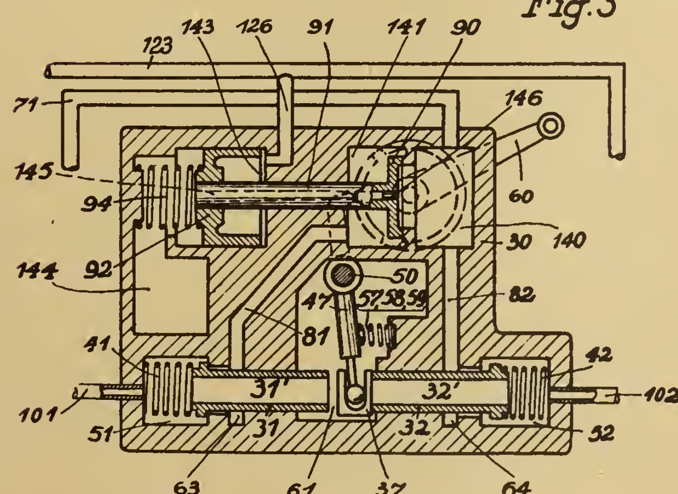


Fig. 3



Inventor:
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Attorney

Published May 4, 1943

Serial No. 284,005

ALIEN PROPERTY CUSTODIAN

LENS HOODS FOR PHOTOGRAPHIC CAMERAS

Max Ruhland, Brunswick, Germany; vested in the Alien Property Custodian

Application filed July 12, 1939

My invention relates to improvements in lens hoods for photographic cameras, and more particularly in hoods of the type comprising an expansible and collapsible hood made from elastic and flexible material such as soft rubber and in the form of conical bellows adapted to be placed with their end of smaller diameter on the lens mount of the camera. One of the objects of the improvements is to provide a hood of this type which may be readily collapsed into a shape such that the folds of the bellows overlie one another in radial direction. Another object of the improvements is to provide a hood in which the extended position light rays falling on the inner surface of the hood are reflected outwardly and so that they do not pass through the lens. With these objects in view my invention consists in constructing each fold composing the bellows of the hood from a part that when the hood is in extended position extends substantially in a transverse plane perpendicular to the axis of the structure and a part which extends from the inner margin of said perpendicular part outwardly and towards the end engaging the lens mount, the part of the innermost fold having a conical shape approximating a cylinder, or extending outwardly from the lens mount and substantially in the said transverse plane.

I am aware that it has heretofore been proposed to construct hoods for camera lenses of the type indicated above, in which the folds of the bellows are composed each of a conical part extending from the inner or smaller side of the hood outwardly and a conical part extending inwardly from the outer margin of said outwardly extending part. Thus, to the incoming rays conical surfaces are presented which are adapted to reflect the said rays inwardly and to the lens. Further, in the said known structure the inner part of the innermost fold extends from the margin of the lens mount inwardly at an angle to the axis of the structure approximating 90°, so that when the hood is collapsed the said innermost part is pressed into a position perpendicularly to the said optical axis thus providing a support on which the folds arrange themselves so as to overlie one another in axial direction.

For the purpose of explaining the invention an example embodying the same has been shown in the accompanying drawing in which the same reference characters have been used in all the views to indicate corresponding parts. In said drawing,

Fig. 1 is an elevation partly in section showing the hood in extended position and engaging the lens mount,

Fig. 2 is a sectional elevation showing the hood in collapsed position,

Fig. 3 is a sectional elevation similar to the one illustrated in Fig. 1 and showing a modification, and

Fig. 4 shows the collapsed hood incased.

In the example shown in Figs. 1 and 2 the hood comprises a body *a* in the form of conical bellows and made from elastic and flexible materials such as soft rubber, the said hood engaging the lens mount *b* with its innermost annular member *c*. Following the said innermost annular member the body *a* comprises a series of folds of successively increasing diameter, and each fold comprises a part *d* in the form of an obtuse cone and extending from its inner margin inwardly at an angle to the axis of the structure approximating zero, and a part *e* extending from the outer margin of said conical part *d* outwardly and in a plane substantially transverse and perpendicular to the said axis of the structure. The bellows consist of a single piece of flexible material, so that all the folds and their parts are made integral.

In the extended position of the hood incoming rays impinging on the inner wall of the hood are reflected outwardly and laterally and so that they do not pass through the lens. Therefore the sensitized film is not impaired by rays of diffuse light. When the hood is collapsed the transverse parts *e* are bent inwardly by the axial stress acting thereon and they place themselves on the conical parts *d* which are slightly bent outwardly and into cylindrical shape. Finally the folds arrange themselves in the position shown in Fig. 2 in which they overlie one another in radial direction. As appears from the said figure, the breadth of all the parts *d* and *e* is alike, and therefore the folds are collapsed into annular space bounded at both sides by planes perpendicular to the axis of the structure.

The modification shown in Fig. 3 is similar to the one so far described. But as distinguished from the construction shown in Figs. 1 and 2, the first part e_1 of the first fold connected with the innermost ring c^1 extends outwardly and substantially in a transverse plane perpendicular to the axis of the structure, and the second part d^1 extends from the outer margin of said perpendicular part inwardly and towards the outer part of the hood. I have found that thereby the collapsing of the hood is effected even more readily, for the reason that in the construction shown

in Figs. 1 and 2 the innermost conical part d has the tendency by axial stress exerted on the hood to be pressed into a plane perpendicular to the axis of the hood so as to lie flat on the front side of the lens mount, and the said tendency must be counteracted by the transverse member e being pressed inwardly and onto the outer face of the member d, while in the construction shown in Fig. 3 the transverse member e_1 has no tendency, and it is pressed inwardly and onto the outer surface of the portion c_1, and the conical part d_1 is pressed on the said transverse part e_1. Further, the collapsed folds overlie the annular member c_1, while in the construction shown in Figs. 1 and 2 they overlie the innermost part d. Therefore, in the construction shown in Fig. 3 the axial length of the collapsed hood is smaller than that of the construction shown in Figs. 1 and 2.

In both constructions the annular member c is fixed to a ring f of sheet metal which is formed with a flange g and prongs h engaging the end faces of the annular member c, c^1, with inwardly projecting prongs n and with spring flaps i engaging the outer circumference of the lens mount b.

When the hood is placed on the lens mount it is held thereon by the clamping action of the spring flaps i, and its inward movement is limited by the inwardly projecting prongs n bearing on the end face of the lens mount.

MAX RUHLAND.

PUBLISHED

MAY 4, 1943.

BY A. P. C

M. RUHLAND

LENS HOODS FOR PHOTOGRAPHIC CAMERAS

Filed July 12, 1939

Serial No.

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Fig. 1

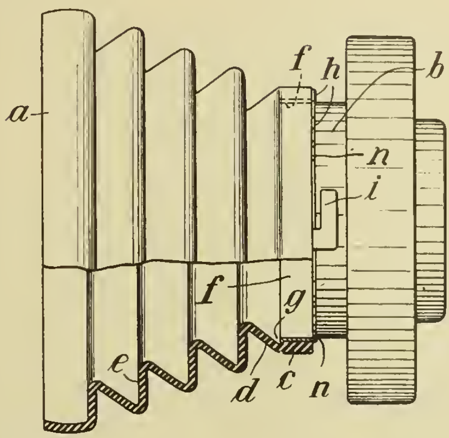


Fig. 2

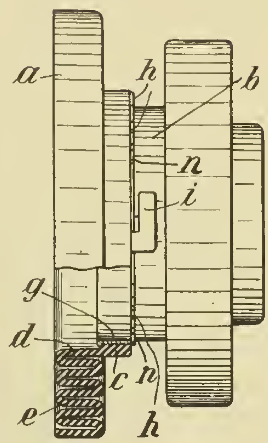


Fig. 3

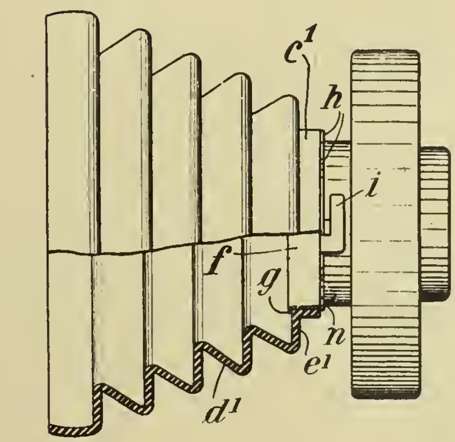
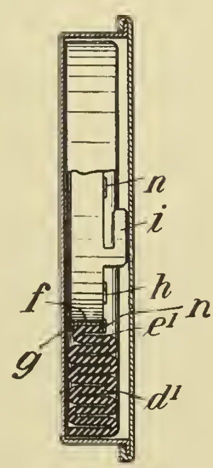


Fig. 4



Inventor:

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Published May 4, 1943 Serial No. 284,328

ALIEN PROPERTY CUSTODIAN

ALTIMETER

Fritz Köhler and Alfred Redehase, Syrau B/Plauen Vgtld, Germany; vested in the Alien Property Custodian

Application filed July 13, 1939

The present invention relates to barometric altimeters being provided with an arrangement for zero adjustment of the height indicator in dependence on the air pressure existing on the ground level.

This zero adjustment has hitherto been principally effected in such a manner that the entire altitude measuring instrument together with the indicator may be revolved around its axis by hand by means of an adjusting knob. The extent of the revolution may be read off against a pointer on a scale graduated in millibars, said scale revolving with the apparatus. The air pressure to be set is transmitted from the ground level station by radio, and the board radio operator has to pass these communications on to the pilot. Through the noise of the motors, however an essential element of uncertainty exists in regard to verbal or even telephonic communications. This refers more particularly to cases where several separately adjustable altimeters have to be used in different locations.

According to the present invention, such disadvantages are removed in that electrically influenced means, such as a magnet or a motor, act upon the measuring instruments, the zero position being changed in accordance with their movements. These means are connected with a current source via a rheostat, the movable member of which co-operates with a scale graduated directly in millibars, so that the zero or the millibar adjustment respectively of the measuring instrument may be effected by the radio operator over any distance by actuating the rheostat. Several instruments may be set in perfect uniformity by a parallel or successive switching of the adjusting means.

In the following an embodiment of the invention is explained in greater detail with reference to the drawings.

Fig. 1 shows a front aspect of the altimeter.

Fig. 2 shows a section through same along the line A—B of Fig. 1.

In Fig. 3 the switching arrangement for actuating the adjusting device is diagrammatically represented.

In all figures the same reference numerals stand for the identical parts.

The numeral 1 represents the front aspect of an altimeter housing having on its front part—facing the spectator—flanges 2. In the flanges there are bores 3 designed to receive the fastening screws. The housing 1 is in front closed by a glass plate 4, said plate being kept in position by a ring 5. Behind the glass plate 4 there are two further rings 6 and 7 which over an intermediate piece 8 keep the scale 9 fixed in a fitting 10 of the casing 1. The scale 9 is graduated so as to indicate the altitude in kilometers. Above the scale 9 an indicator 11 is rotatably arranged, said indicator being actuated from the measuring instrument of the altimeter, as described below. In the scale 9 there is in addition a window 12 through which a scale 13 is visible, said scale 13 being graduated in millibar values. The indicator 11 is fixed on an axle 14 and is put into a revolving motion upon a deflection of the diaphragm capsule 21 via the gear wheels 15, 16, a toothed segment 17 as well as the shaft 18 and the levers 19 and 20. The capsule 21 is of the known aneroid type; the interior of the housing 1 is connected with the outer air through a tubular connecting piece 22, it being thus achieved that the deflection of the indicator 11 corresponds to the altitude reached at the time.

The capsule 21 is secured by means of a connecting piece 23 and a nut 24 screwed on to the latter at a frame 25 serving at the same time as bearing for the above mentioned gear wheels 15, 16, the toothed segment 17, the shaft 18 and the levers 19 and 20. This frame is rotatable at 26 in a bearing lodged in the back wall of the casing 1, so that consequently the capsule 21 together with the indicator 11 may be adjusted in relation to the scale 9, in which manner it becomes possible to consider the factor of the existing ground level pressure. Simultaneously with this adjustment the corresponding millibar value becomes visible in the window 12.

According to the invention, the adjustment is effected by electrically actuated means, as for instance by a motor 27 being likewise fixed at the back wall of the casing 1 and the rotor 32 of which transmits its movement via a pinion 28 to a gear wheel 29, which is fixed on the frame 25 by means of screws 30. The current supply of this motor is derived in the usual way via the clamping screw 31.

The switching arrangement of the motor 27 shifting the frame 25 as well as the indicator 11 is shown in Fig. 3. This arrangement is one of the known kind usually employed for distant adjustment of any species of signals or machine parts based on the principle of the Wheatstone bridge. The rotor 32 of the motor 27 used for the adjustment is located in the compensating branch e of the bridge formed by the resistances a, b, a', b', the field winding 33 of the motor 27 being excited from the current source 34. The ratio of the resistances a and b is changed

by actuation of the handle **35**, the free end of which is provided with an indicator **36** moving over a scale **37** graduated in millibars. The motor **27** is actuated by the compensating current generated in the branch *e*, said motor shifting about the lever **38** on the resistances *a'* and *b'* until the balance has been re-established, moving at the same time the frame **25** and the indicator **11** of the altimeter via the gear wheel **28**. The scale **9** having been graduated to correspond with the respective millibar values of the scale **37**, it follows that the indicator **11** may be brought into a relative position to the scale **9** indicative of the existing ground level pressure.

Without any essential deviation from the invention, naturally other electrically actuated means for the adjustment of the indicator corresponding to the millibar values may be employed. Thus the adjustment might for instance be effected by an electromagnet being within the circuit of a rheostat graduated in millibars, the armature of said magnet transmitting in suitable manner to the indicating member its position corresponding to the varying degrees of current intensity.

FRITZ KÖHLER.
ALFRED REDEHASE.

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F. KÖHLER ET AL
ALTIMETER
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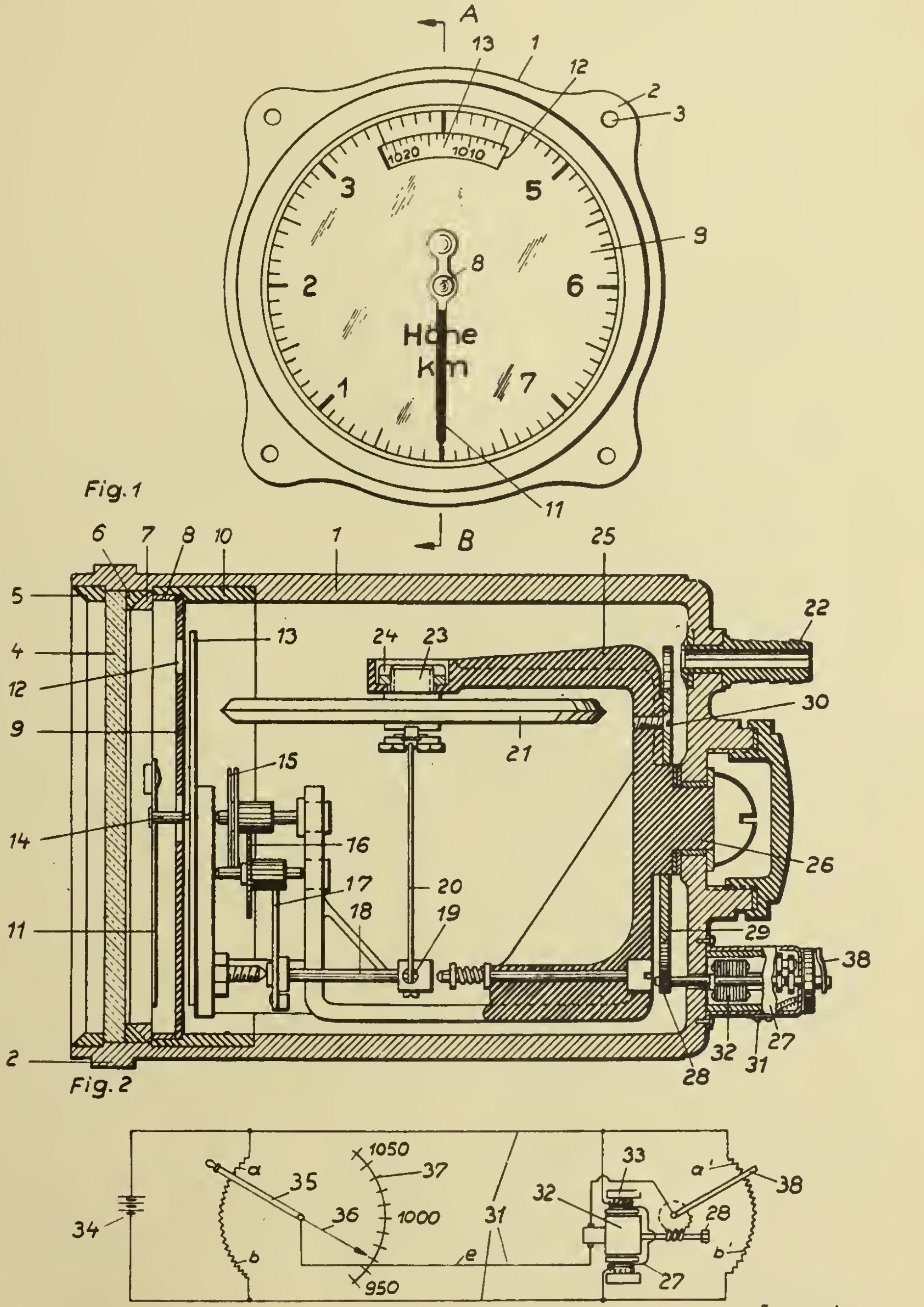

Fig. 1

Fig. 2

Fig. 3

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ALIEN PROPERTY CUSTODIAN

AUTOMATIC TRANSMISSION

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Application filed July 19, 1939

This invention relates to an automatic transmission, and more particularly to an arrangement for automatically shifting a speed-change gear in response to the reaction torque developed in an intermediate torque converter.

An object of this invention is to provide a novel, simple automatic transmission system.

Another object of this invention is the provision of an automatic transmission system wherein means are provided for automatically shifting a speed-change gear in response to the torque on the reaction member of an intermediate torque converter.

Still another object of this invention is the combination of a fluid drive and speed-change gear, wherein said gear will be automatically shifted to maintain the fluid drive at its maximum efficiency for varying conditions of load and speed.

A further object of this invention is the provision of an improved transmission consisting of hydro-kinetic torque converter and speed-change drive, wherein the speed changes are produced automatically in response to the torque on the reaction member of the torque converter.

Further objects and advantages of this invention will be apparent from consideration of the specification as illustrated by the accompanying drawing of possible embodiments of the invention in which drawings:

Fig. 1 is a schematic drawing of a preferred form of a complete power plant arranged in accordance with this invention;

Fig. 2 is an enlarged view of the automatic transmission control device diagrammatically portrayed in Fig. 1;

Fig. 3 is a diagram illustrating the characteristics and operation of the transmission system;

Fig. 4 is a partially diagrammatic view of a modified arrangement of the system illustrated in Fig. 1, and

Fig. 5 is an enlarged view illustrating certain details of the modified system portrayed in Fig. 4.

A preferred form of this invention is schematically illustrated in Fig. 1 which shows a prime mover **1**, which may be an internal combustion engine, drivably connected to a torque converter **2** of the hydro-kinetic type having an impeller **3**, a turbine **4** and a reaction member **5**, and thence to a speed-change drive generally indicated at **6**. This power system is particularly adapted for use with a vehicle, such as a motor or railway vehicle, but obviously is not limited to use in this connection alone.

The reaction member **5** of the hydro-kinetic torque converter **2** is preferably provided with an extended crank arm **7** which cooperates with a control device **8** for the control of the automatic speed-change **6**.

A conduit **9** leading to the transmission control device **8** for a purpose hereinafter described is connected to the pressure side D of a pump, here shown as a gear pump **10**, drivably connected through the worm **11** with the impeller **3**. A throttle **12** is preferably provided between the pressure side D of the pump **10** and the sump, while a conduit **13** supplies fluid to the pressure side S of the pump **10**.

The speed of the internal combustion engine serving as the prime mover **1** is adapted to be controlled by a throttling vane **14** in the fuel supply, which is interconnected through link rod **15**, crank **16** and link rod **17** with the usual foot pedal **18**. Additional control of the throttling vane **14** is also effected by the Bowden wire control device **19** connected to the opposite end of the crank **16** from the link rod **17** for a purpose to be hereinafter described. The wire **19** leads to the control device **8**, (shown more fully in Fig. 2) which is also interconnected with the transmission **6** by means of the control cable **20**. While the transmission **6** may be of any well known remote controlled type, it is preferably electrically controlled in a manner well known to the art and the connecting cable **20** may then contain the control wires for the electric transmission control device.

Referring more particularly to Fig. 2, the construction and operation of the control device **8** interconnecting the reaction member of the torque converter for control of the automatic speed-change drive **6** will now be described with more particularity. In order to resist and oppose the torque on the reaction wheel **5**, the crank arm **7** connected thereto is preferably movable between two piston drives **21** and **22** which include movable pistons **23** and **24** respectively, having respective hollow pressure spaces **25** and **26** to which a fluid under pressure is suppied from the pump **10** through conduit **9**. The pistons **23** and **24** are additionally urged against the crank arm **7** by suitable means such as internal helical springs **27** and **28**. It will thus be seen that the crank arm **7** is movable in either direction between the piston abutments **29** and **30**, depending upon the direction and amount of the reaction torque upon the reaction wheel **5**, as

compared with the abutting force produced by the pistons **23** and **24** through the springs **27** and **28** and the internal fluid pressure which, in turn, is dependent upon the speed of the pump **10** drivably connected with the impeller **3**.

For controlling movement of the automatic transmission **6** by the movement of the crank arm **7**, a link rod **31** may be pivotally connected to the far end of the crank **7** and at its other end to a two-armed lever **33** shown as pivotally movable about a point **32**. A second link rod **34** pivotally connected at the other end of the two-armed lever **33** actuates a double pawl and ratchet mechanism actuating a rotatable member **35** upon which is resiliently mounted a switch contacting arm **36**. Through this arrangement, movement of the crank lever **7** in one direction or the other will move the contact arm **36** from one contact **37** to another contact which will then electrically actuate the various changes in the transmission **6**, in a manner well known to the art.

The switch arm **36** is also preferably provided at its opposite end with a notched section **38** against which one end of a pivoted two-armed lever **39** is sprung, the other end of this lever being attached to the wire **19**, connected as above described with the throttling vane **14** of the engine **1**. The notches are so correlated with the contact **37** that while the switch arm **36** rests upon a contact, the wire **19** will be in a normal position which does not affect the position of the throttling vane **14**. However, intermediate the contact **37** the notched section **38** will raise the end of the lever **39** pressing against it to move the wire **19** in such a direction that through the crank **16** and the link rod **15** the throttling vane **14** will be moved to its idling position. Thus, during the switching step, power is removed from the torque converter which not only assures a quick positive switching movement, but additionally permits the use of any type of clutching means in the automatic transmission, such as a direct-driving or dog clutch.

It is to be noted that the pivot **32** for the linkage system interconnecting the crank arm with the switch for the automatic transmission **6** is mounted upon a hand lever **40**, pivoted at **41** and held in place by a temporary holding member **42**. If it is desired to remove the control of the automatic transmission from the crank arm **7**, the hand lever **40** may be disengaged from the temporary holding member **42**, whereupon the pivot point **32** may be moved as desired and thereby move the switch arm **36** in either direction at will. This arrangement is of particular importance when it is desired to use the engine as a brake, in which case the transmission may be moved through the hand lever to a lower driving step. By restoring the hand lever **40** and the pivot point **32** to their original positions, automatic control of the transmission is instantly reinstated.

By reference to Figs. 1, 2 and 3, the operation of the above-described system will now be set forth. In order to clarify the sequential operation, the various torques and forces arising have been given particular designations. The torque of the impeller **3** may be designated as M_1, while the speed of this member has been designated at n_1. Except during starting and during the time the engine is idling through control of the throttling vane **14**, both M_1 and n_1 remain substantially constant. The torque and speed of the turbine member have been correspondingly respectively designated as M_2 and n_2. Fig. 3 illustrates the manner in which M_2 will vary with increasing n_2 while at the same time n_1 will remain substantially constant. Fig. 3 has been plotted to show the variations of M_2 with increasing n_2 for both full throttle of the driving motor (solid lines) and partial throttle of the same (dash lines). The efficiency of the torque converter **2** is at its maximum when the transmission radio is approximately 1:1. This efficiency varies during increasing speed n_2 of the turbin element **4** as has been indicated in Fig. 3, wherein such efficiency is designated as η.

During initial starting of the engine the torque M_1 of the impeller **3** will be relatively small, that upon the stationary turbine element **4** (M_2) very large, and the torque upon the reaction member **5** which may be designated as M_L will be correspondingly large, resolving itself into a force M_L^{III} as shown in Fig. 2. This force M_L^{III} will be so large, and the opposing reaction force M_S^{III} so small due to the low pressure resulting from slow speed n_1 of the impeller **3**, that the crank arm will move toward the right, as seen in Fig. 2 to hold the switch arm **36** in the lowest driving connection. As the engine comes up to speed n_1 will soon reach a constant value as will the impeller torque M_1. At the same time, the pressure within the reaction piston will also increase. During this period n_2 will be increasing while M_2, as seen in Fig. 3 will decrease. Shortly a point will be reached at which M_2 will be less than M_1 which will then result in a torque on the reaction member **5** acting in the opposite direction and indicated in Figs. 2 and **3** as M_L^I. As n_2 increases to provide a slight overdrive, M_L^I will have increased to such a degree as to overcome the reaction force M_S^I and moves the crank arm **7** to the left. As shown in Fig. 3, this may occur at the turbine rotor speed n_2^I.

As soon as the switch arm **36** moves to the next higher step and the transmission **6** is placed in a higher gear, the torque M_2 will greatly increase over its previous value, and, to be sure, to such an extent that the torque upon the reaction wheel **5** may reverse and produce a force against the abutment indicated by M_L^{II}. This reversed force will not, however, be sufficient to overcome the opposing force of the abutment M_S^{III} and the crank arm **7** will accordingly not move sufficiently to the right to cause a reversed action of the switch mechanism. After the transmission has moved to the higher step, the speed of the turbine wheel **4** will be approximately n_2^{II} as indicated in Fig. 3. This speed will then gradually increase again and switching to additional higher speed will occur in substantially the same manner as described above for switching from the first to the second speed, until the highest step in the transmission has been reached.

If the vehicle is ascending a hill, or for any reasons whatsoever the load thereon is greatly increased, the speed of the vehicle and thus that of the turbine wheel **4** will be reduced thus increasing the torque M_2. When the speed has been reduced to a point such as n_2^{III} as indicated in Fig. 3 the torque on the reaction member **5** will be of such a value M_L^{III} that it will act in such a direction and have sufficient value to move the brake arm **7** against the reaction force M_S^{III} to move the crank lever to the left, as seen in Fig. 2, thus switching the transmission from a higher to a lower gear. This change in transmission ratio will immediately decrease the torque M_2 while the speed of the turbine mem-

ber **4** will increase to n_2^{IV} and produce a reverse force M_L^{IV} acting against the reaction force M_S^I, M_L^{IV} is, however, less than M_S^I and the crank arm cannot therefore continue moving to the left to again actuate the transmission to a higher step to nullify the previous reduction.

If the previously described reduction in transmission ratio is not sufficient, the apparatus will operate to reduce the drive until the lowest step has been reached.

In all cases between steps, due to the action of the notched sector **38** moving the wire **19**, the engine speed will be reduced. This removes the additional pressure from the pistons **23** and **24** and thus assures a quick positive movement of the crank arm providing, in turn, a quick positive movement of the switch arm **36**. In this manner oscillation and "hunting" of the crank arm **7** are avoided.

It is to be particularly noted in connection with the operating curves illustrated in Fig. 3 that the maximum efficiency of the converter will occur approximately when the turbine element **4** has a speed n_2^V. The apparatus is so designed, however, that the range of speed covered by each transmission step are such that the efficiency never falls below η_1, which is not far from η_{max}. This is true not only for full throttle of the prime mover, but also is true for partial loading.

As a further important modification of the construction described above, it is possible that other means than the pump and pressure-operated pistons may be used to supply the reaction force opposing movement of the crank arm **7** attached to the reaction member **5**. Such an alternate arrangement has been illustrated in Figs. 4 and 5, where a generator **110** suitably geared to impeller **3** may supply current proportionate to the speed of the impeller through conductors **112** and **113** to electro magnet windings **125** and **126** which control respective armatures **123** and **124**. The stationary members **121** and **122** serve in this case as guides for the armatures and as abutment for springs **127** and **128** pressing against the armatures **123** and **124** respectively. In this case the control device as a whole and as so modified has been designated as **108**. It is obvious that the operation of the system illustrated in Figs. 4 and 5 will produce proportionately the same results as that illustrated in Figs. 1 and 2.

While the principles of this invention are particularly applicable to the transmission of power for an automotive vehicle, it is obvious that its use may be extended to other vehicles, such as, for example, to the driving of railway vehicles, tractors, ships, elevators, etc. The exact type of prime mover is without importance. Furthermore, it is contemplated that other types of torque converters than the hydro-kinetic torque converter illustrated may be used. For example, an hydraulic converter of the displacement type could be utilized, as could be mechanical and electrical torque converters. In all cases, however, in accordance with the principles of this invention, the automatic transmission would be controlled by the torque produced upon the reaction member.

Instead of an indirect control of the transmission, it is also contemplated that the reaction member of the torque converter may control the transmission directly, as by suitable mechanical interlinkages. This is possible because in many cases, particularly with power vehicles, the guiding wheel torque M_L reaches a very high value so that large forces are present which may be utilized to effect the mechanical switching step.

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Fig. 1

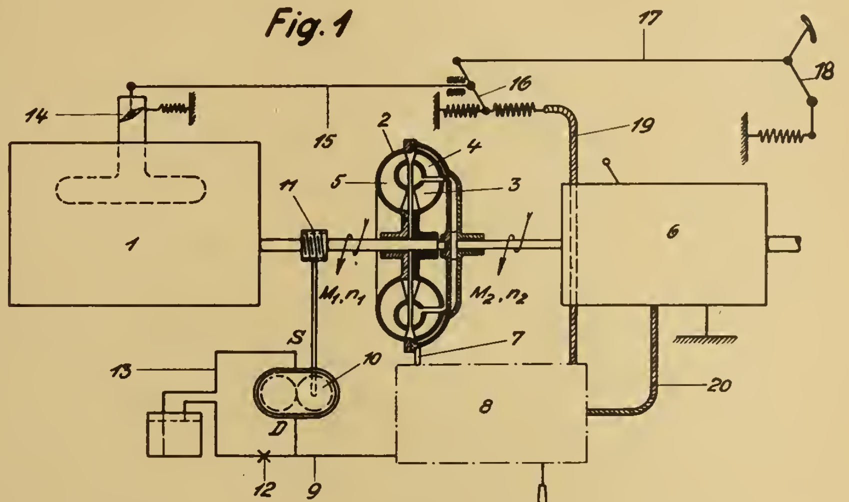
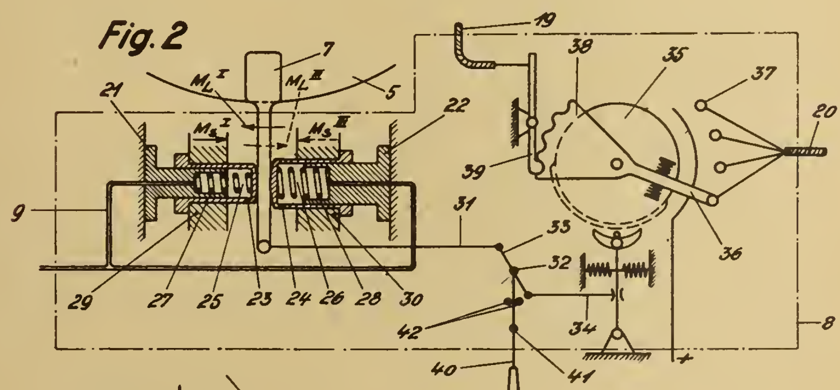


Fig. 2



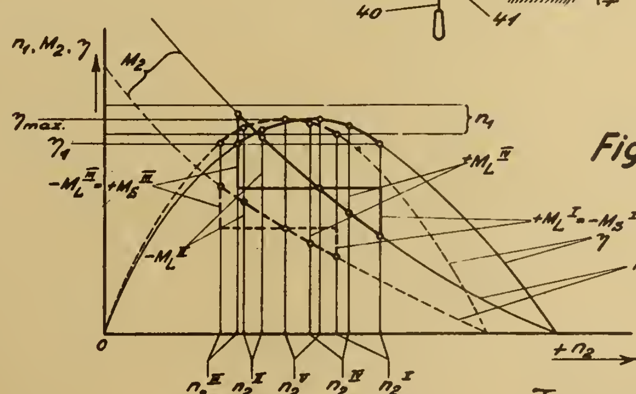


Fig. 3

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Fig. 4

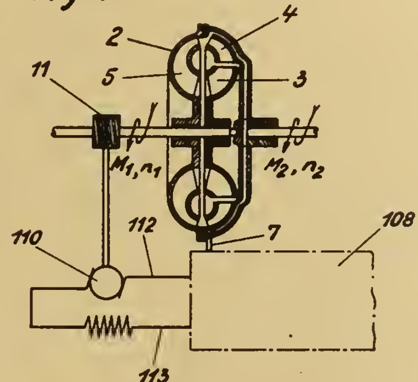
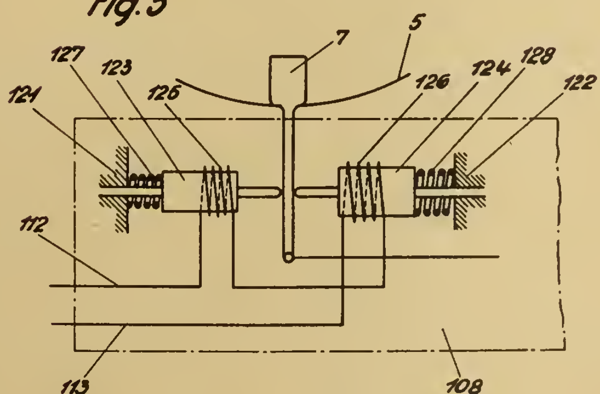


Fig. 5



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ALIEN PROPERTY CUSTODIAN

OPERATING ARRANGEMENT, PARTICULARLY FOR CHANGE-SPEED GEARING FOR MOTOR-VEHICLES

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Application filed July 19, 1939

The invention relates to an operating arrangement, particularly for change-speed gearing for motor vehicles, especially self-synchronising change-speed gearing with a clutch-operating sleeve and several operating rods located side by side. The invention resides generally in the provision of an element giving a variable transmission ratio between the gear lever and the sleeve such that the portion of the movement of the knob or head of the gear lever utilised for synchronisation is increased and the movement thereof utilised for clutch-dog engagement is reduced in relation to the movement of the sleeve.

In the operation of synchronising devices, two stages of operation are to be distinguished, namely the synchronisation which requires a not inconsiderable expenditure of force and must be performed in a comparatively short movement of the sleeve and the engagement of the clutch dogs which requires only a very slight expenditure of force but calls for a comparatively large movement of the sleeve. The extent of the whole movement of the knob of the gear lever is fixed and, having regard to convenience of operation, cannot be increased. According to the invention, therefore, operation is facilitated by shortening the portion of the whole movement available for clutch-dog engagement, which requires but little force, to the advantage of the portion of the movement available for synchronisation, which requires considerable force. In this fashion, the force to be exerted over a certain movement during synchronisation is reduced and the force to be exerted for the engagement of the clutch dogs is increased, that is a more uniform expenditure of force during the operation is achieved.

The invention is carried into practice by the provision of an element giving a variable transmission ratio between the knob or head of the gear lever and the clutch-operating sleeve, the said element acting upon the operating rods with a constantly varying effect.

The invention is thus of advantage for gearing with a synchronising arrangement because, owing to the variable transmission ration, the force to be exerted at the knob of the gear lever can be made uniform in spite of the varying resistance to operation in the synchronising arrangement. As is known, the resistance arising at the commencement of synchronisation is considerably greater than that at the end of synchronisation and during engagement of the clutch dogs. These two resistance forces multiplied by the respective operating movements of the sleeve give the work to be expended at the knob of the gear lever. Now, by the provision of the variable transmission ratio, the result may be achieved that the resistance to operation, at the knob of the gear lever, is constant or approximately so. Consequently, a smaller operating force need be exerted upon this knob for the same operating movement or, with a certain operating force, which is dependent upon the masses to be synchronised within a certain time, it is possible to make do with a smaller operating movement at the said knob.

A further advantage of the invention is that the usual finger provided on the gear lever can be in constant engagement with the other operating elements and permits, without force-wasting wedging action and with simple space-saving means, of the selection of the appropriate operating rods for required gear changes and of their actuation in reliable fashion. Owing to the uniformity of the resistance to operation, as felt at the knob of the gear lever, and owing to the avoidance of the wedging members previously common in such operating arrangements, the unpleasant pressure point which has appeared in all self-synchronising gearing hitherto cannot be felt during operation in the case of the invention.

Another advantage of the invention is that, in the case of a fixed or standardised arrangement of gearing and operating rods, the operating order can be adapted to suit any desired scheme, without further reconstruction, merely by the insertion of a different operating sleeve.

Furthermore, the invention permits of the operating means being arranged without, in particular, upwardly projecting parts, so that, with the said operating means arranged at one end of the gearing, the cover of the gear-box may be kept low and flat and welcome freedom for the driver's feet on the floor of the motor vehicle directly above the gearing may be secured.

Finally, the invention is particularly advantageous for five-speed gearing, because it is possible to make do with only three operating rods. Moreover, the invention is especially advantageous for five-speed gearing wherein a fifth forward speed is provided as a so-called overdrive. The gear-lever movements for the first and second speeds and the third and fourth speeds respectively may then lie in one plane and also the less-used speeds, namely the first and the reverse speeds, may be controlled in simple fashion by one operating rod.

The invention is illustrated in several examples of construction and application in the accompanying drawing, in which—

Figure 1 shows one form of operating arrangement in longitudinal section, the operating sleeve occupying a central neutral position,

Figure 2 a detail plan view of the sleeve of Figure 1,

Figure 3 a detail plan view of three operating rods located side by side,

Figure 4 a cross-section through the arrangement on the line A—A in Figure 1, the sleeve occupying a central position in the transverse direction also,

Figure 5 a cross-section similar to Figure 4 with the sleeve displaced transversely.

Figure 6 a longitudinal section similar to Figure 1 with the sleeve in a rocked position,

Figure 7 a second form of operating arrangement in longitudinal section, with the gear lever offset in relation to the sleeve,

Figures 8 to 12 details of the arrangement of Figure 7 in plan view,

Figure 13 the arrangement of Figure 7 in cross-section,

Figure 14 a five-speed change-speed gearing with a synchronising arrangement to which the operating arrangement is advantageously applicable, in longitudinal section, and

Figure 15 an operating diagram for the arrangement in accordance with Figures 7 to 13 or for the gearing in accordance with Figure 14.

In the constructional example in accordance with Figures 1 to 6, the gear lever **1** is mounted in the usual fashion by means of a spherical joint **2** in the cover **3** of the gear box. The operating finger **4** of the gear lever engages by means of a further spherical joint **5** with the actuating lever arm **6** of a sleeve **7** which is mounted in rotatable and longitudinally displaceable fashion upon a transverse rod **8**.

Projecting in opposite directions from the sleeve **8** are pairs of fork arms **9, 9** and **10, 10** respectively between the ends of which small rollers **11** and **12** are rotatably mounted. In the example of Figures 1 to 6, the rollers **11** and **12** lie opposite to each other at the same level in one longitudinal plane B—B (Figures 1 and 2).

Mounted in longitudinally displaceable fashion below the above-described rocker **9, 10**, in a frame **13** which may be rigidly connected to the gear box, are three operating rods **14, 15** and **16** which are preferably disposed parallel to one another and which, within the range of rocking of the rocker, run into flat bars or bridge pieces **14*a***, **15*a*** and **16*a*** disposed on edge. The bridge pieces **14, 15*a*** and **16*a*** have vertical recesses **17, 18, 19, 20, 21** and **22** (Figure 3) within the range of rocking of the rollers **11, 12**. Seen in the transverse direction, the recesses **17, 18, 19** on the one hand and the recesses **20, 21** and **22** on the other hand lie in line. In the example in accordance with Figure 3 the rods **14** and **15** carry, outside the frame **13**, on the right-hand and left-hand sides respectively sleeves **23** and **24**, for example for supporting an operating dog, a shifting rod for a displaceable clutch part, a displaceable wheel or the like. Similarly a sleeve may be secured on one or both ends of the central rod **15**, or a shifting rod **25** or an operating dog may be attached directly to the bridge piece **15*a***. Self-evidently, within the scope of the invention, such shifting rods or dogs may also be arranged on the bridge pieces **14*a*** and **16*a*** and, conversely, the rod **15** may act upon other or additional shifting rods. It is also possible, within the scope of the invention, to cause the rods to act upon two-armed levers so that the direction of the movement transmitted is reversed. Each rod, **14—16**, has notches or depressions **26** for engagement by detent balls **28**, loaded by springs **27**, which hold the rod in its operative position for the time being.

The manipulation and manner of operation of the arrangement described above is as follows:

Depending upon the nature of the gearing to be operated, whose construction may in itself be of any desired kind, first of all preliminary speed-selection is effected by bringing the rocker **9, 10** over that rod **14, 15** or **16**, or its bridge piece **14*a***, **15*a*** or **16*a***, by which the required shifting member is actuated. Either the gear lever **1** is left in the central position illustrated in Figure 4, in which case the rocker remains in the central position shown, or the said lever is swung so that its finger **4** is rocked into the position **4*a*** or **4*b*** (Figure 5). The rocker accordingly assumes a transverse position displaced either to the right or to the left (Figure 5) whereby the rollers **11** and **12** are brought above the recesses **17, 20** or **18, 21** or **19, 22** which determine the operation to be effected. When this has been done, the gear lever **1** is moved forwardly or rearwardly in the longitudinal direction, whereupon the finger **4** rocks the rocker **9, 10** in the manner shown in Figure 6. Assuming that the rocker is brought to the central position shown in Figure 4 and is then rocked counter-clockwise as shown in Figure 6, the roller **11** enters the recess **18** in the bridge piece **15*a*** of the rod **15**. Since the roller **11** describes an arc about the axis **8**, the bridge piece **15*a*** is displaced to the left and the shifting rod or operating dog **25** produces the desired action. The movement of the roller **11** in the direction of movement of the rod **15*a*** is initially only slight. Consequently the roller exerts a correspondingly greater operating pressure upon this bridge piece. With progressing rocking movement, the rate of this movement steadily increases but the pressure decreases, likewise steadily, assuming a uniform movement of the gear lever **1** or of its finger **4**. The same process takes place if the rocker **9, 10** is swung in the clockwise direction.

In the example described above, the gear lever is arranged directly above the operating rods. Frequently, however, it is desirable to displace the gear lever more or less towards the front end of the gear box in order to secure space directly above the gearing, for example in order to secure a certain freedom for the driver's feet in the case of motor vehicles. Such an arrangement is illustrated in Figures 7 to 13. There the finger **4** of the gear lever **1** engages in a sleeve **29** which is fast upon a rod **30** mounted in rotatable and longitudinally displaceable fashion. A lever arm **33** with a ball-shaped actuating head **34** is mounted at some distance from the sleeve **29** upon the rod **30** by means of a spline arrangement **31, 32** so as to be prevented from rotation, although longitudinally displaceable, in relation thereto. The arm **33** is, however, also prevented by two stops **35, 36** from accompanying the rod **30** in longitudinal movement. On the other hand, the arm **33** can turn with the head **34** between stops **35** and **36** (Figure 8). The said head **34** engages in the fork **37** (Figures 7 and 9) of a two-armed lever **38, 39** which is mounted on the cover **3** of the gear box so as to be swingable about a pivot **40**, preferably in a horizontal plane. The rounded end **41** (Figure 9) of the lever arm **39** engages from above in a recess **20** in a second rod **42** displaceable transversely of the rod **30** and the pin **44** of an actuating head **45** belonging

to a rocker hereinafter described projects from below into a recess **43** located opposite to the recess **20**. The head **45** projects between two transverse bars **46, 46** of a fork frame **47** (Figs. 7 and 10) which is rotatably mounted at the inner end of the rod **30** but is prevented by appropriate guiding means from rotating with the said rod. On the other hand, longitudinal movement of the frame **47** with the rod **30** is possible without hindrance.

The above-mentioned rocker from which the head **45** projects between the fork members **46, 46** consists, as in the previous example, of a sleeve **48** mounted displaceably upon a rod **49** which is located parallel to the rod **42** (Figures 7, 11 and 13). Projecting from the sleeve **48** in opposite directions, there are two fork arms **50** and **50¹** at whose ends small rollers **51** and **52** are rotatably mounted. In this instance, the rollers **51** and **52** are offset in relation to each other with reference to their longitudinal planes by the distance *a* (Figure 11).

Three operating rods **54, 55** and **56** are again arranged side by side, below the rocker shown in Figure 11, in a frame **53** in such fashion as to be non-rotatable but longitudinally displaceable. The operative positions of each rod may be determined by a spring-ball detent **57** (Figure 7).

Within the range of rocking of the rocker, the rods **54, 55** and **56** run into flat bridge pieces **54***a*, **55***a*, and **56***a* which stand on edge and are located parallel to one another and a short distance apart. This distance *a* (Figure 12) corresponds to the offset *a* between the rollers **51** and **52** (Figure 11) of the rocker. The bridge pieces **54***a*, **55***a* and **56***a* have vertical recesses **58, 59, 60, 61, 62** and **63** (Figure 12) within the range of rocking of the rollers. Referring to Figures 7 and 12, the rod **54** has at its right-hand end a sleeve **64** with an operating fork **65** (Figure 7). The rod **56** carries a similar sleeve **68** with a fork **69** at the left-hand end. The fork **70** of the rod **55** is directly attached to the bridge piece **55***a* of this rod.

In Figure 14, the operating forks **65, 69** and **70** are indicated by broken lines. In the illustrated gearing actuated by these forks, a driving shaft **72**, a driven shaft **73** located in alignment therewith and a counter-shaft **74** are mounted in the gear-box housing **71**. The driving shaft **72** carries a fixed toothed wheel **75** immediately at its point of entry into the housing **71** and, similarly, a wheel **76** is fixed upon the driven shaft **73** near the wall of the housing. Wheels **77, 78** and **79** are mounted so as to be non-displaceable longitudinally but freely rotatable upon the driving shaft **72**. The wheels **76, 77, 78** and **79** are permanently in mesh with wheels **80, 81, 82** and **83** which are fast upon the countershaft **74**. The sides adjacent to each other of the wheel pairs **77, 78** and **79, 76** are constructed as the halves **84, 85, 86** and **87** of clutches and between these wheel pairs change-speed clutch parts **88** and **89** are mounted upon the driving shaft **72** in relatively non-rotatable but longitudinally displaceable fashion. These clutch parts are constructed as synchronising clutch halves for both of their directions of movement so that the final connection of the parts to be coupled together is only effected when they have approximately the same revolution speed. The construction of each synchronising clutch as a combined friction and dog clutch is preferred, the dog-clutch part being displaceable against resistance upon the friction-clutch part and the friction-clutch parts coming into engagement before the dog-clutch parts. The wheel **77** has also a sleeve **90** extending towards the wheel **75**. This sleeve is provided externally with splines or grooves **91** and a displaceable wheel **92** slides non-rotatably thereon. The wheel **75** on the driving shaft **72** is in permanent mesh with one wheel **93** of a preliminary gearing and the same shaft of the preliminary gearing carries two further fixed wheels **94** and **95**. The wheel **95** meshes in turn with an intermediate wheel **96** with which rotates a wheel **97** on the same intermediate shaft. The wheel **92** on the sleeve **90** may be brought alternatively into engagement with either the wheel **94** or the wheel **97**. The clutches **88** and **89** are operated by sleeves **98** and **99** and the wheel **92** is moved by a third sleeve **100**. As Figure 14 shows, the operating fork **65** engages in the sleeve **99**, the fork **70** in the sleeve **98** and the fork **69** in the sleeve **100**.

The operating diagram for the gear lever **1** for an arrangement in accordance with Figures 7 to 13 in combination with gearing in accordance with Figure 14 is illustrated in Figure 15. The manipulation and manner of operation of the arrangement in accordance therewith are as follows:

Upon swinging the gear lever **1** in the direction only of the plane of the drawing (Figure 7), the finger **4** swings oppositely and causes longitudinal displacement of the rod **30** with the fork frame **46, 47**. The fork members **46** then act in the same direction upon the actuating member **42** of the rocker **50, 50¹** and rock the latter. The downwardly swinging roller **51** or **52** of this rocker enters into the particular recess **58** to **63** located under it in a bridge piece **54***a*—**56***a* of an operating rod **54**—**56** and moves the same in the opposite direction to the rod **30** so that the required action is initiated.

Similarly the finger **4** executes an opposite movement to the gear lever **1** when the latter is swung transversely, i. e. at right angles to the plane of the paper. The transverse movement of the finger **4** causes rotation of the rod **30**. Accordingly the lever arm **33** with the knob **34** also executes a turning movement (Figure 8) and causes, through the fork **37**, a swinging movement of the two-armed lever **38, 39** (Figure 9). The end **41** of the two-armed lever displaces the rod **42** (Figure 13) which in turn displaces the actuating member **45** in the transverse direction between the fork members **46**. Consequently, the rocker **50, 50¹** (Figure 11) also executes a transverse movement and the rollers **51** and **52** are thereby brought over respective recesses **58**—**63** in the bridge pieces **54***a*—**56***a* of the operating rods **54**—**56** so that, upon subsequent longitudinal movement of the gear lever in the above-described fashion, a certain roller comes into engagement with a certain rod and the operating movement is completed as described above. The various speeds are engaged by a movement of the gear lever in accordance with the diagram in Figure 15. The several recesses in the rods are indicated in Figure 12 by the numbers of the speeds. The directions of operation may be gathered both from Figure 7 and also from Figure 14.

For the first speed, the wheel **92** is brought into engagement with the wheel **94**. The wheel **75** on the shaft **72** drives the wheel **93** and the wheel **94** drives the displaceable wheel **92**. The wheel **92** carries along the sleeve **90** and the wheel **77** by reason of the spline connection **91** and the wheel **77** drives the wheel **80** fast on the shaft **74**.

The drive is finally transmitted by way of the wheel pair **83**, **76**.

For the second speed, the clutch part **88** is brought into engagement with the clutch half **85**. In this fashion, the wheel **78** is clutched to the driving shaft **72** and drives the shaft **74** through the wheel **81**. The drive is again finally transmitted by way of the wheel pair **83**, **76**.

For the third speed, the clutch part **88** is brought into engagement with the clutch half **84**. In this fashion, the wheel **77** is coupled to the driving shaft **72** and drives the shaft **74** through the wheel **80**. The drive is again finally transmitted through the wheel pair **83**, **76**.

For the fourth speed, the clutch part **89** is brought into engagement with the clutch half **87**. The wheel **76** which is fixed directly upon the driven shaft is connected to the driving shaft **72**. Consequently the fourth speed is the direct speed.

For the fifth speed, the clutch part **89** is brought into engagement with the clutch half **86**. In this fashion, the wheel **79** is connected to the driving shaft **72** and drives the shaft **74** through the wheel **82**. The drive is again finally transmitted through the wheel pair **83**, **76**.

For the reverse speed, the displaceable wheel **92** is brought into engagement with the wheel **97** whereby the wheel **92**, in comparison with the case of its engagement with the wheel **94** for the first speed, experiences a reversal of its direction of rotation. Otherwise the power transmission and movement takes place, precisely as for the first speed, by way of the wheel pairs **77**, **80** and **83**, **76**. In this case also, the drive is finally transmitted by the wheel pair **83**, **76**.

In connection with this mode of operation, it is notable that there is a constant final drive **83**, **76** for all indirect speeds. This arrangement in accordance with the invention has the advantage that all wheel pairs on both sides of the synchronising clutches are always drivingly connected to the driven shaft or, in the case of vehicles, to the Cardan shaft. Consequently, only a small synchronising force is necessary and not only is the loading of the synchronising clutches slight but also the operating device is of small size.

The operating diagram for the gear lever naturally depends upon the arrangement of the operating rods and also upon the offset of the rollers on the rocker. For instance, within the scope of the invention, it would be possible to construct the preliminary gearing, including the first and reverse speeds, as a so-called silent gearing with permanently meshing toothed wheels and to operate the same by means of synchronising clutches. Similarly, within the scope of the invention, the functions of the clutch **88** between the wheels **77** and **78** may be interchanged so that the first speed and the reverse speed include the ratio of the second speed. In place of the rollers **51** and **52** on the rocker **50**, **50**[1], provision may naturally be made of any other desired kind of engagement members, such as sliding blocks. Similarly the individual rods may carry any desired number of operating forks in any desired arrangement. Furthermore, there is no reason why the rocker should not be provided with more than two operating arms **50**, **50**[1], the length of the lever arm of the actuating member **45** and the lengths of the said arms being suitably proportioned in any desired fashion. Within the scope of the invention, it is further possible to provide several rockers instead of one and also several actuating levers **33** (Figs. 7 and 8).

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OPERATING ARRANGEMENT, PARTICULARLY FOR CHANGE-SPEED GEARING FOR MOTOR-VEHICLES

Filed July 19, 1939

Serial No. 285,333

4 Sheets-Sheet 1

Fig. 1.

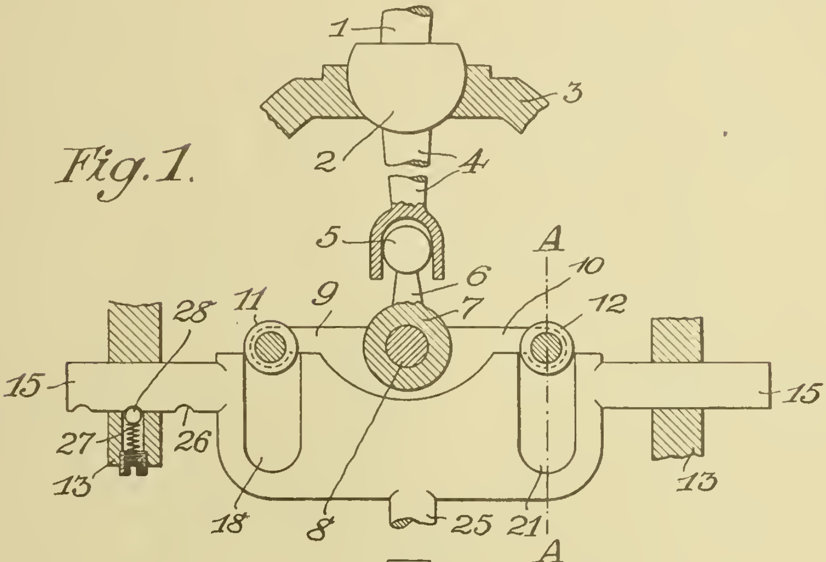


Fig. 2.

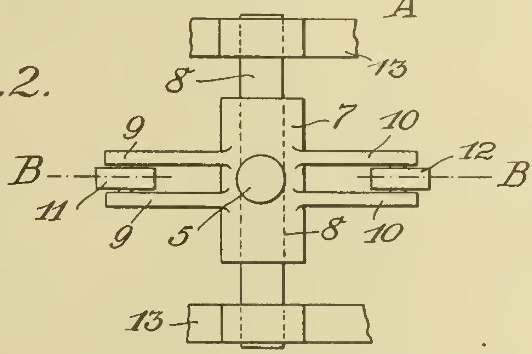
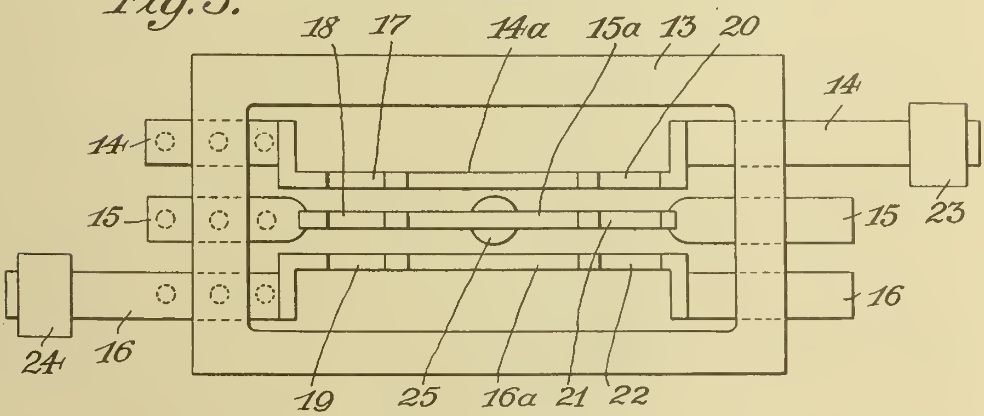


Fig. 3.



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4 Sheets-Sheet 2

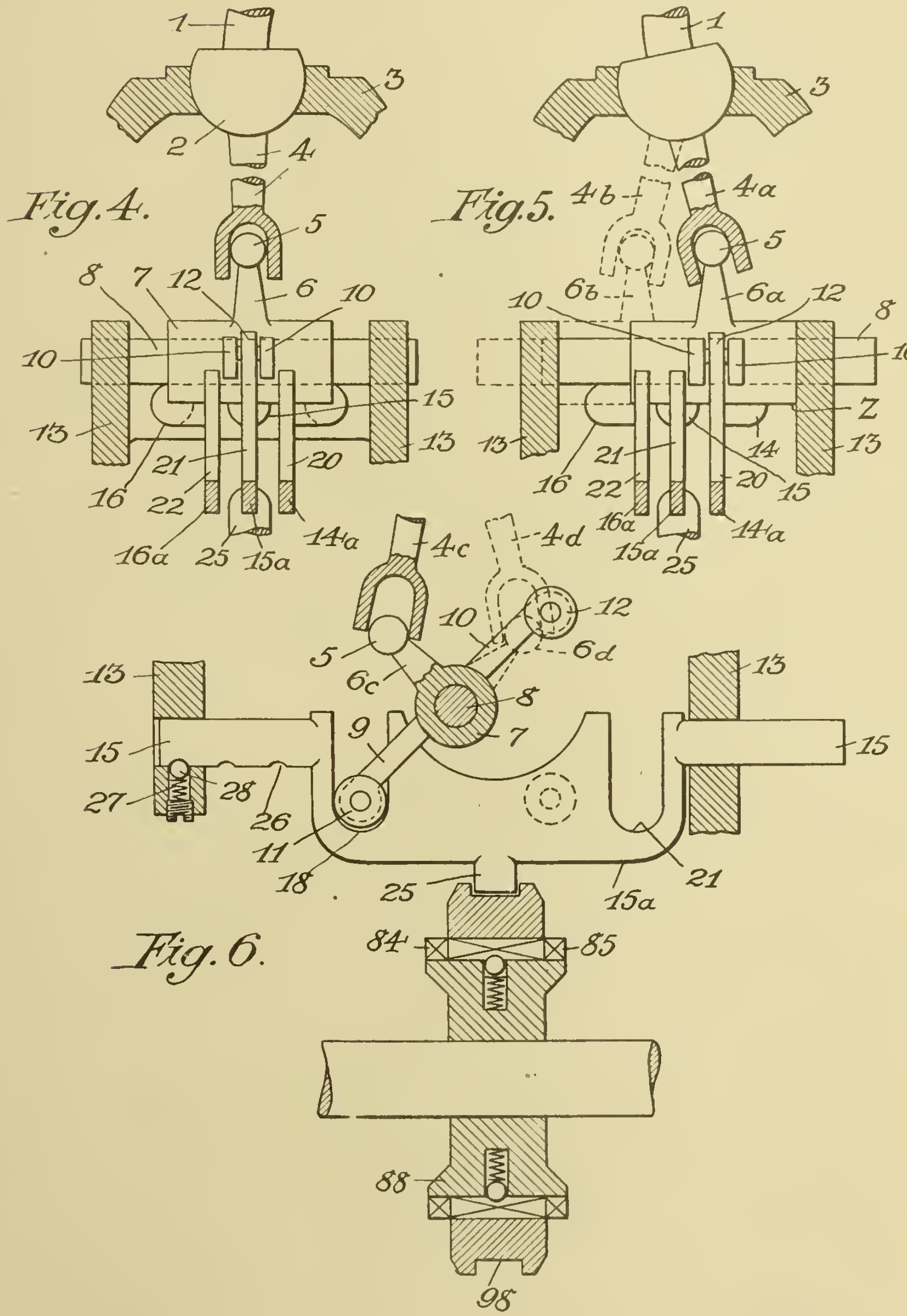

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Fig.7.

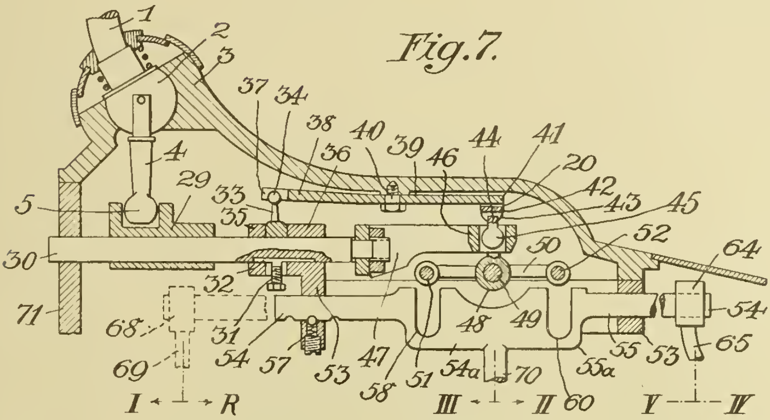


Fig.8.

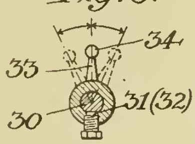


Fig.9.

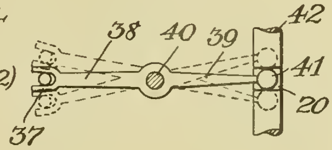


Fig.10.

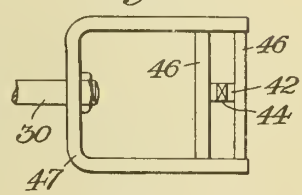


Fig.11.

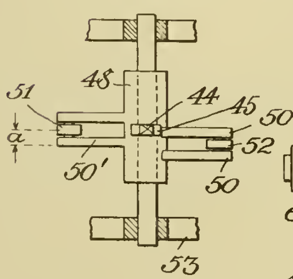


Fig.12.

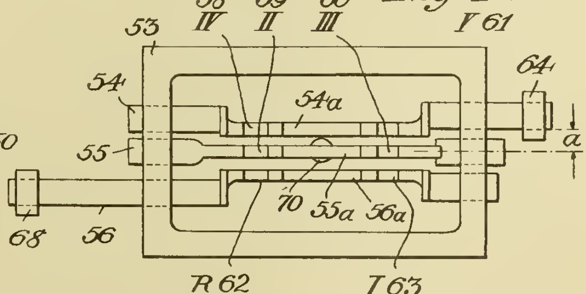
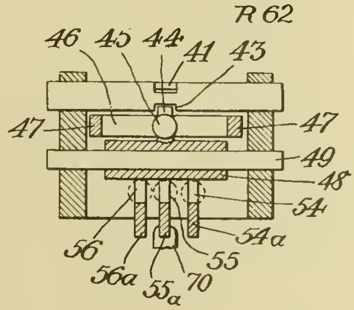


Fig.13.



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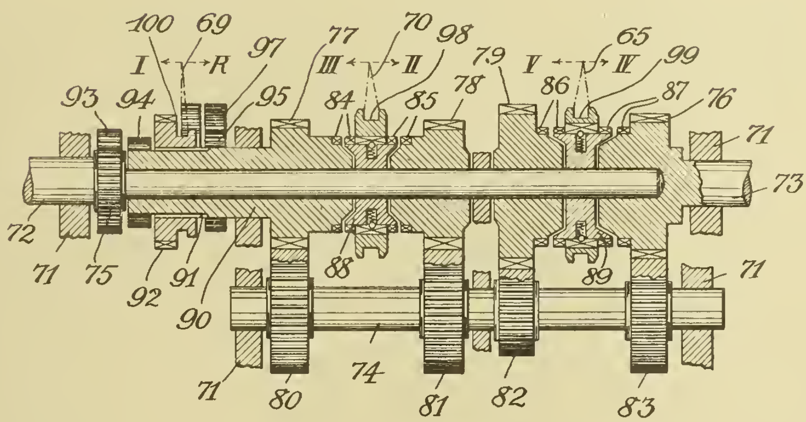
4 Sheets-Sheet 4

Fig. 14.



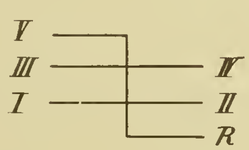


Fig. 15.

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ALIEN PROPERTY CUSTODIAN

EQUIPMENT FOR SUBAQUEOUS ARMS DESTINED TO BRING ABOUT THE FIRING OF SAME WHEN TRAVERSED BY A GALVANIC CONTACT CURRENT

Pasquale Borracci, Firenze, Italy; vested in the Alien Property Custodian

Application filed July 22, 1939

The invention concerns a device which receive galvanic currents obtained in the water by the iron portions of a floating body and by the copper portions connected to a mine or the like. The said device causing, through the action of this galvanic current, the play of a set of levers, the last of which brings about a mechanical action capable of sending out an electric current, disconnecting, for instance, the axis from the armature of a generator provided with a coiled spring, or the like, so that on its being actuated, it shall afford an electric current adapted to fire the arm. The device is such that although highly sensitive to the influence of magnetic currents, it is unaffected by mechanical actions—shocks, vibration, etc.—from the exterior.

The invention will best understood on following the specification and the accompanying drawing which shows, schematically, a practical example of the carrying out of the said invention.

In said drawing

Fig. 1 is a perspective general view of the apparatus;

Fig. 2 shows the said apparatus in operation in one of the modes of application;

Fig. 3 is a detail of the mooring cable which also performs the functions of a lower antenna.

Fig. 4 shows schematically the spring means for imparting a determinate position to the coil.

According to the example delineated, the apparatus is obtained with two coils a'—a'' rotating in the magnetic field of two permanent magnets b'—b''.

The two coils are provided with mutually reversed electric windings, so that under the influence of the galvanic current, the one turns in a direction opposed to that of the other.

The armature of the two coils are perfectly equilibrated relatively to their axes of rotation c'—c''. Beside this coil—according to the example—there is a dynamo d whose armature is connected to a previously coiled, torsional spring, and is destined to supply the current for the firing of the small electric fuze pertaining to the mine; this dynamo is locked to the rotating coils by means of a special system of levers, which we will proceed to describe.

The locking system is constituted as follows: Upon a suitable base e is fixed a small trestle f which carries a small roller g capable of rotation. The said roller carries two shafts integral therewith: the former h disposed horizontally, the latter i disposed vertically. The shaft h is intended to support the extremity of a lever k pivoted at k'. The shaft i is provided at its lower part with a counter-weight i', and at its upper part it is suitably bent at an angle in order to bear, at the lower extremity thereof, against one of the two sectors l of an organ capable of rotation.

Two appendages m—m' are integral with the two coils a'—a'' and engage with two slots carried by the organ provided with the said two sectors l—l.

The lever k is provided with a projection k'' against which bears the extremity n' of a lever n fulcrumed at n''. The other extremity of the said lever n is likewise provided with a projection n''' upon which rests the free extremity of another lever o fulcrumed at o'. This lever o also carries a tooth o'' against which bears a projection p' carried by the sleeve p, jutting out from the dynamo d. The spring destined to actuate this dynamo is tightened by means of the square d' and the corresponding jack d''.

The levers k—n are perfectly equilibrated relatively to their centre of rotation by means, for instance, of counter-weights, not shown in the drawing; the lever o may also not be equilibrated.

Each coil is provided at the central part thereof, viz. at the parts facing each other, with a small spiral spring. For the sake of clarity in the drawing the small springs are not shown in Fig. 1; one of them, however, is clearly represented in Fig. 4 in which the spring r is seen to be fixed at one end thereof to the axis of the coil, and at the other end to a support s of the said coil. These small springs serve the purpose of holding the coil in a given position until same is without any current, so that the element of sector l may always be in a symmetrical position relatively to the appendix i; precisely until there is no longer any passage of the current. And these small springs are organs which suffice to maintain the determinate position, which is—in short—the position for which the two small pins m—m' retain the sector in the desired symmetrical position, represented in the drawing, and adapted to afford a central support for the appendage i in the solid field of one of the sectors l.

As is apparent from Fig. 2, the apparatus is placed within the torpedo t, which when submerged in the water is moored to the anchor u by means of a cable v, which, as may especially be seen from Fig. 3, is partly wrapt in insulating material v'. Round this insulating material is wound copper wire v'' which constitutes the lower antenna, that is, the lower electrode. The upper electrode, instead, is composed of an uncovered copper cable x, carried by a cable-buoy y also made of copper.

The operation takes place as follows:—on the iron hull of a floating body coming into contact with the two antennae x v, or with the buoy y, a galvanic pile is fermed, whatever may be the concentration of the sea-water. This improvised galvanic pile causes a weak current to circulate through the next circuit; the current starts, for instance, from the buoy; it flows through the upper antenna x connected to the wire z (Fig. 1) and proceeds to circulate through the coil a' of the apparatus, from whence, passing through the wire **2** it enters the coil a'', and issues from same through the wire **3** connected to the lower antenna v; the water, which constitutes the pile electrolyte, closes the circuit between the antenna v and the hull.

The current circulating through the coils creates a magnetic field, which, under the influence of the magnetic field existing in the two permanent magnets b'—b'', causes the rotation of the winding spirale and, with same, of the two coils a'—a''. And as the said windings are, as stated above, turned in mutually reversed directions, the coils turn in a direction being opposed, the one, to that of the other. At the end of each coil drum is located—as has been seen—the respective contact pin m—m' or the like. These contact pins thus cause the action, viz. the rotation, of the sector element l—l in one direction or in the other, according as the upper or the lower antenna is struck.

Due to the slight rotation of l the shaft appendage i springs into one of the gaps of the said element; herethrough the small roller g is permitted to perform a slight rotation under the action of the pressure of the lever k which bears against the appendage h of the said small roller.

This lever, thus, on the raising of its extremity k'', liberates the lever n, which rotates while lowering the extremity n''' thereof. Then, the lever o turns about the pivot o', raising its extremity o'' and freeing the tooth p' from the sleeve p. Hereby the dynamo armature, which is charged with a spring or other means, is left free to rotate, thus generating the current, which, through the conductors **4**—**5** is conveyed to the charge-igniting fuze.

Of course, the shifting of the lever o may bring about any other action—the closure of a circuit, activation of a pile or the like, capsule of generating current.

PASQUALE BORRACCI.

PUBLISHED MAY 4, 1943. BY A. P. C.

P. BORRACCI

EQUIPMENT FOR SUBAQUEOUS ARMS DESTINED TO BRING ABOUT THE FIRING OF SAME WHEN TRAVERSED BY A GALVANIC CONTACT CURRENT

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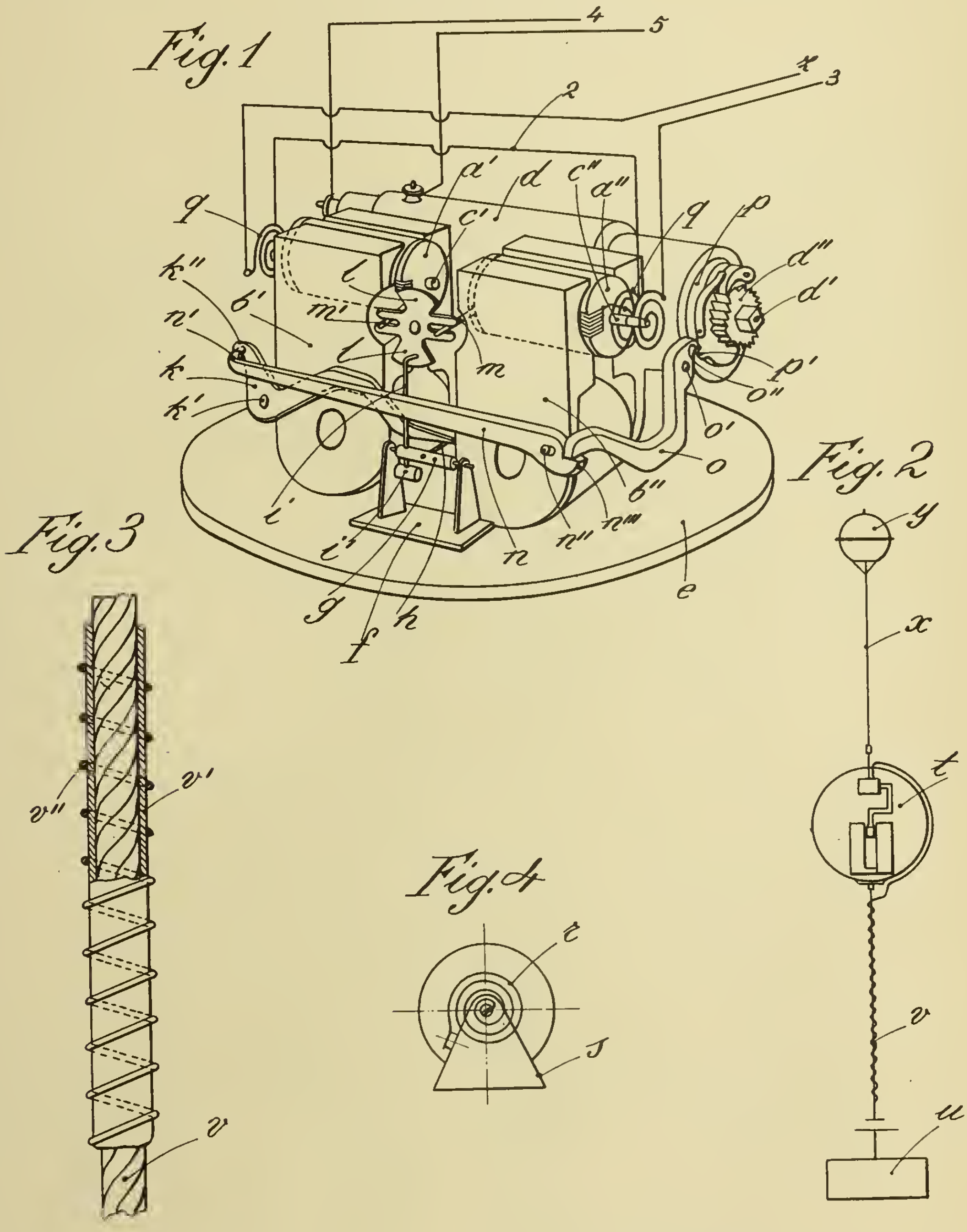

Pasquale Borracci
INVENTOR
By [signature]
his Att'y.

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ALIEN PROPERTY CUSTODIAN

PURIFICATION OF PIG IRON

Johannes Haag, Neunkirchen, Germany; vested in the Alien Property Custodian

No Drawing. Application filed July 22, 1939

The invention relates to a process for the purification of pig iron containing at least 0.1% of chromium.

It is known that iron ores with higher contents of chromium, for example 0.5%, cannot be directly smelted as only a small proportion of the chromium is taken up by the slag in the blast furnace, the main proportion going into the pig iron and remaining therein during the conversion to steel so that the properties of the steel are influenced in a frequently very undesirable manner. For example, even a comparatively small proportion of chromium reduces the weldability and also very seriously diminishes the case with which the steel can be cold worked, for example by cold rolling, cold drawing or deep drawing.

There are, however, large supplies of iron ore which contain a high proportion of iron of from 40–65%, together with appreciable quantities of chromium. These ores have, however, so far only been smelted in small quantities because there was no satisfactory method of removing the chromium in the slag in sufficient quantities.

The invention has for its object to enable high grade iron ores containing chromium to be smelted in such a way that the quantity of chromium remaining in the steel will no longer exercise a detrimental effect during its further treatment. This is achieved according to the invention by adding to the charge before, during or immediately after the purification of pig iron containing at least 0.1% of chromium, a quantity of an iron oxide, for example rolling mill scale, such that the chromium content in the metal is reduced to less than 0.06%. The process can be carried out in all furnaces which serve for the purification of pig iron.

It is known in the purification of pig iron in open hearth furnaces to add iron oxides, in particular iron ores, but it was not hitherto recognized that by the addition of sufficient quantities of iron oxide it is actually possible to remove in the slag the greater part of the chromium contained in the pig iron.

If insufficient quantities of iron oxide of the necessary purity are available, the process according to the invention, when the purifying operation is carried out in a converter, can be varied by purposely overblowing the charge, i. e. by supplying a quantity of air in excess of the theoretical quantity with consequent overheating of the charge and the production therein of considerable quantities of iron oxide. This iron oxide then has the same effect as added rolling mill scale, i. e. an appreciable quantity of the chromium content is removed in the slag. When using this method it is necessary to reckon with high degree of burning and a strong deoxidation is often required after the purification is ended. With this method good results can however be obtained, and particularly when manganese is added in an easily oxidizable form, for example as manganese dust. The manganese clearly operates as an oxygen transferrer because it accelerates the slagging of the chromium quite appreciably. Consequently it is convenient always to add manganese after oxygen or oxides in some form have been incorporated in the charge.

In the following table are set out the results of several experimental melts.

Charge Nr.	Pig iron kg.	Pig iron analysis						Steel analysis						Rolling mill scale in kg.	Manganese dust (67%) kg.
		Mn%	P%	S%	Si%	Cr%	Ni%	C%	Mn%	P%	S%	Cr%	Ni%		
7432	20, 000	0, 39	1, 67	0, 050	0, 46	0, 22	0, 08	0, 054	0, 51	0, 071	0, 056	0, 10	0, 08	------	------
7436	19, 900	0, 38	1, 65	0, 051	0, 45	0, 22	0, 08	0, 052	0, 53	0, 058	0, 053	0, 10	0, 07	------	------
7446	19, 000	0, 40	1, 62	0, 056	0, 46	0, 22	0, 08	0, 047	0, 38	0, 035	0, 049	0, 05	0, 07	200	------
7449	24, 100	0, 40	1, 62	0, 065	0, 48	0, 22	0, 09	0, 045	0, 39	0, 060	0, 065	0, 04	0, 08	400	------
7452	20, 240	0, 41	1, 66	0, 070	0, 46	0, 22	0, 08	0, 028	0, 27	0, 045	0, 062	0, 03	0, 08	600	------
7457	21, 950	0, 37	1, 67	0, 068	0, 41	0, 22	0, 08	0, 047	0, 36	0, 050	0, 065	0, 03	0, 08	800	------
7983	19, 440	0, 62	1, 95	0, 039	1, 08	0, 10	0, 08	0, 046	0, 46	0, 046	0, 045	0, 02	0, 07	600	------
7982	20, 200	0, 62	1, 94	0, 037	1, 08	0, 11	0, 08	0, 06	0, 47	0, 064	0, 037	0, 04	0, 07	------	100

Whilst for example in the case of melts 7432 and 7436 the chromium content of 0.22% in the pig iron sank to 0.01% in the finished steel, it was found possible with the same chromium content in the pig iron to reduce the chromium content in the steel,

In the case of melt 7446 by the addition of 200 kg of rolling mill scale to 0.05%,

In the case of melt 7449 by the addition of 400 kg of rolling mill scale to 0.04%,

In the case of melt 7452 by the addition of 600 kg of rolling mill scale to 0.03%, and

In the case of melt 7457 by the addition of 800 kg of rolling mill scale to 0.03%.

In the case of melt 7983, in which a pig iron containing 0.01% of chromium was used, it was possible by adding 600 kg of rolling mill scale, which was added half a minute after the decarbonization, to reduce the chromium content to 0.02%.

stage of six times, at the third stage of nineteen times, and at the fourth stage a transmission multiplication of sixty times can be obtained.

This transmission rate is only true however assuming that the rolling members roll with their greatest diameter against the inner and outer rings. If the rolling circle of the outer ring on the balls is displaced to the side of their greatest running circle towards their true axis, for example to the point 23 as shown in Figure 3, a further additional speed transmission is effected. In this constructional example illustrated in Figure 3, the proportion of the rolling circle of the outer ring on the drive transmitting balls to that of the inner ring is 1:3. By this means an additional threefold transmission is attained in all the speed stages.

The speed drive according to the first example, carried out and applied in a cycle hub in the manner illustrated in Figure 6, is furnished with three sets of rolling members, and is coupled with a hub dynamo 42. For ease of reference, the components of the drive are given the same reference numerals as in the first three stages of the drive shown in Figure 1.

For coupling and uncoupling the drive, a nut member 43 is adjustably arranged on the fixed spindle 19 of the wheel and engages with a pin 44 in an axial bore 45 in the spindle 19, and by its rotation causes the conical point of the pin to force a keying member 46, which is freely housed in a radial bore in the spindle, into a slot 47 of the hub part 20 of the first ring comb or cage 21, and thereby secures the ring comb 21 firmly to the spindle to effect the coupling of the drive. The nut member 43 is reversely rotated to uncouple the drive, so that the point of the pin releases the keying member 46 and this returns automatically from the slot 47 of the comb ring or cage 20, 21. The transmission of the final speed stage to the rotor of the dynamo 42 takes place through the inner ring 10 of the third and last stage.

In the constructional embodiment of the speed drive illustrated in Figure 4, all the rolling members are disposed under uniform axial pressure in inclined running tracks. The first stage of this drive consists of an outer ring 2 immovably secured on the fixed wheel spindle 19, a freely rotatable inner ring 4, which is made in one piece with the outer ring 5 of the second stage, and a set of rolling members 3 which are carried around by a comb or cage 24 securely connected to the driving shell 1. The rolling members 3 transmit their own motion in an accelerated manner to the inner ring 4 and therewith also to the outer ring 5 of the next speed stage. The rolling members 6 of the next higher speed stage are held against rotation involving change of place by means of the comb 25 secured on the fixed spindle 19 of the wheel, so that by their own rotation they transmit the movement of the outer ring 5 in an accelerated manner, but opposite direction, to the inner ring 7 of the speed stage.

The inner ring 7 of the second speed stage is made in one piece with the outer ring 8 of the third speed stage. The rolling members 9 of the third speed stage are set in rotation by the driving shell 1 by means of a comb 25 and receive through their opposite rotating outer ring 8 an additional acceleration. The rolling members 9 with enhanced local rotation drive their inner ring 10 and therewith the outer ring 9 of the fourth speed stage in the same sense of rotation as the drive shell 1. The rolling members for the fourth speed stage are held fixed as to position, but free to rotate, by the comb 27 secured on the fixed spindle 19 so that they only act as intermediate wheels in the movement transmitted to the inner ring 13 in an accelerated manner but in a sense opposed to the direction of rotation of the drive shell 1, which inner ring is securely connected to the outer ring of the next speed stage.

In order to obtain greater acceleration of the rolling members 28 of the fifth stage than is obtainable through the drive from the shell 1, the comb or cage 29 between the rolling members is coupled directly with the outer ring 11 of the fourth stage. Since the comb 29 in this way rotates oppositely to the outer ring belonging to the set 28 with accelerated speed in contrast with the drive shell 1, the transmission to the inner ring 30 of the fifth stage is greater than in the other stages. The transmission to the last stage of the drive is effected by means of the outer ring 31 and a set of rolling members 33 held fixed as to place by a comb 32 secured on the spindle, by which the inner ring 34 and the rotor 35 of a dynamo or the like coupled to it is rotated at the greatest rate of revolution of the whole drive. This transmission also gives an acceleration.

In the speed drive illustrated in Figure 5 the rolling members 3, 6, are arranged in circular series around conical wheels 36 and are rotatably mounted on stub axles 37 which in the first stage are secured to an outer ring 38 and in the second stage are formed as arms 39 from the conical wheel 36 of the first stage.

Both sets of rolling members 3, 6, possess fixed outer tracks 40 which have a conical form corresponding to that of the conical wheels. The movement imparted to the first set of rolling members from the driving ring is transmitted with acceleration to the conical wheel by reason of the fixed outer, track, and this wheel by its rotation carries around with its arms the set of rolling members of the second stage. This set in its turn, drives the conical wheel of the second stage, which drives in an accelerated manner as described either the set of rolling members of the third stage or the object to be driven at speed.

The number of stages of all three drives is dependent only on the number of revolutions desired and the capacity of the particular drive in employment.

As rolling members, balls or rollers may be employed, the latter however preferably being of barrel shape, since owing to their broad bearing surface they exhibit the least tendency to slip.

The speed drive can also be successfully employed for large transmissions from high speed to low speed.

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PUBLISHED

MAY 4, 1943.

BY A. P. C.

A. RABL

SPEED DRIVE FOR FAST RUNNING MACHINES
ESPECIALLY FOR CYCLE DYNAMO MACHINES
Filed July 28, 1939

Serial No.
287,152

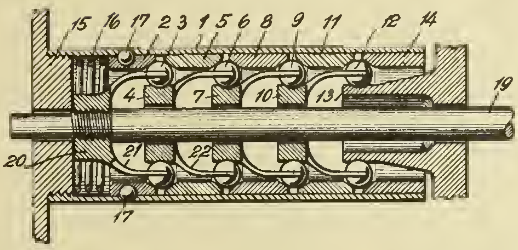


Fig. 1

Fig. 3

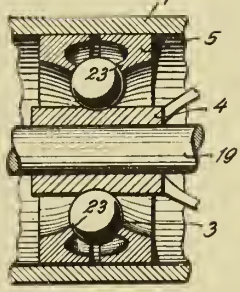


Fig. 2

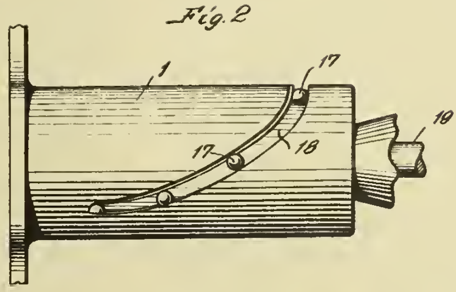


Fig. 4

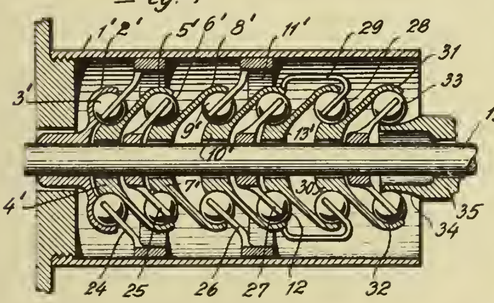


Fig. 5

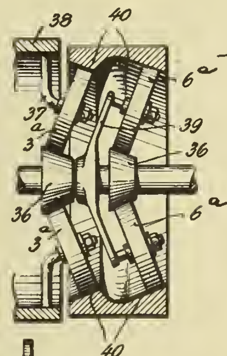


Fig. 6

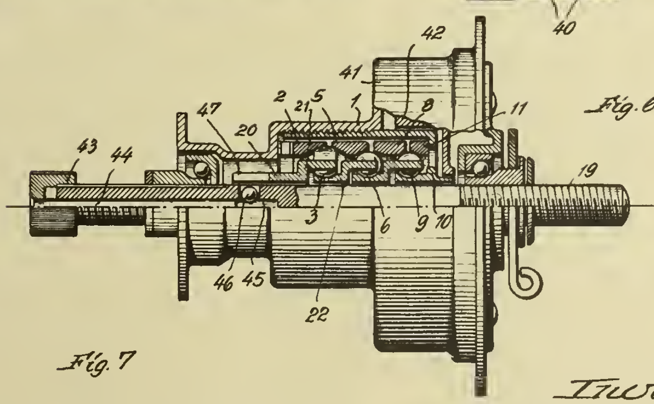
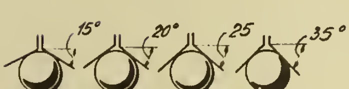


Fig. 7



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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF FIRST RUN METAL OR STEEL FROM STEEL PIG IRON OR OF A BESSEMER PIG IRON CONTAINING PHOSPHORUS

Franz Bartscherer and Walter Eichholz, Duisburg-Hamborn, Germany; vested in the Alien Property Custodian

Application filed August 7, 1939

Patent application Ser. No. 272,044 shows, that it is possible to blow steel iron from steel or first run metal in a basic converter. Recent investigations have shown that the analysis of the pig iron to be blown may vary within the widest limits. Thus, for example a steel iron with 0.15% Si; 2.5–3% Mn; 0.1–0.5% P or a steel iron with 0.5% Si; 0.5–1.5% Mn; 0.1–0.5% P can be perfectly blown to steel if the pig iron possesses sufficient physical heat. The possibility of carrying out the process from a metallurgical and technical point of view has no limit as regards the content of C, Mn and Si in the pig iron. Consequently, there is no difficulty to convert into steel a steel iron with for example 2% Si, more than 4% Mn and 4% C.

Other investigations have proved, that in the blowing of steel pig iron by the using in different quantities and for different periods of time the otherwise usual admixtures such as lime, scrap and ore, it is possible, contrary to the known state of the art, to influence the course of the charge to a far greater extent than in the conversion hitherto used. Thus, it has been unexpectedly discovered that by different lime additions the course of the charge can be influenced to a far higher degree than is known for example from the Thomas or Bessemer process.

Figs. 1 and 2 of the accompanying drawing are diagrams showing examples of this possibility of influencing the charge.

Fig. 1 shows a charge with high percentage of lime and/or high charge temperature and Fig. 2 shows a charge with small lime addition and intensive cooling. If ordinary steel iron with for example 4–4½% C; 2–3½% Mn; 0.8–1.2% Si and 0.1–0.3% P is blown at normal temperature with slag cooling with or without a small addition of lime, as shown in Fig. 1, it is possible, if the blast is interrupted at the proper time, to obtain a duplex metal with about 1.5 C and 0.8–1% Mn, and a slag with 30–35% Mn, 30–40% SiO_2; 5–10% MgO+CaO; 0.1–0.5% Fe and 0.0–0.5% P_2O_5, or if the charge is finished blown a steel is obtained with about 0.02% C, 0.2–0.3% Mn and 0.05–0.07% P and a slag with 25–35% Mn; 25–35% SiO_2; 10–20% CaO+Mgo and 10–15% Fe.

If, on the other hand, only lime is added instead of the cooling scrap and in such a quantity that the cooling effect of the lime corresponds to that of the scrap and the lime addition is greater than is necessary for the binding of SiO_2 and P_2O_5, it is possible, under suitable conditions, to obtain a first run metal with about 1.5% C and 2–2.5% Mn, and a corresponding slag with 10–15% Mn; 20–30% SiO_2 and 40–50% CaO, or a steel with 0.02% C; 0.6–1% Mn; 0.02–0.05% P and a corresponding slag with 20–25% Mn; 15–20% SiO_2, 35–45% CaO and 8–10% Fe.

It has also been found that, when blowing steel pig iron, the temperature has a considerably stronger effect on the course of the charge than is the case with other converting processes. If the temperature of a steel iron charge is increased with at the same time the highest possible addition of lime either by increasing the Si content in the pig iron or by increasing the physical heat of the pig iron, or by the omission of the usual cooling additions of scrap and the like, the manganese burning can be weakened to such an extent that when blowing to a first run metal with about 1.5% C the manganese content has only decreased slightly and amounts to 2.5–3% with a slag composition of 2–10% Mn; 1–5% Fe; 40–50% CaO and 30–40% SiO_2. When blowing to finished steel the Mn content under these conditions may attain 0.8–1.1% with 0.02% C and 0.02–0.05% P (see Fig. 1). The corresponding slag then contains 10–20% Mn; 25–35% SiO_2; 40–45% CaO and 8–10% Fe.

If, on the other hand, the charge is cooled by the addition of large quantities of scrap with or without a small lime addition, 0.6–0.8% Mn is obtained in the first run metal with about 1.5% C and in the corresponding slag 30–40% Mn; 30–40% SiO_2; 5–10% MgO+CaO and very small Fe and P contents, or in the steel 0.15–0.2 Mn with 0.02% C and 0.05–0.07% P and in the slag 30–40% Mn; 25–35% SiO_2; 10–20% MgO+CaO and 8–12% Fe (see Fig. 2). These two examples show that when blowing steel pig iron it is possible, contrary to the Thomas process, for example, with suitable treatment of the melting process, to produce both a steel with a Martin analysis and also one with a Thomas analysis. It must also be mentioned, and this constitutes part of the invention, that all addition of ferro manganese can be dispensed with when preparing the charge, if it is desired to produce a high Mn percentage in the finished steel.

It was further unexpectedly found that the above mentioned possibility of influencing, the extent of which was hitherto unknown in the blasting processes, can be assisted by an addition of ore, rolling scale or some other oxygen carrier, to an extent as was hitherto entirely unknown. If, for example with a steel iron charge which is blown exclusively with scrap cooling without or only with a small addition of lime, ore

is added during the first minutes, such a strong Mn burning is attained that the manganese content of the first run metal with about 1.5% C, only amounts to about 0.5–0.6%, whereas the slag contains 30–40% Mn; 30–35% SiO_2; 5–10% CaO+MgO and about 5% Fe. If such a charge is blown to finished steel, the following result is obtained:—

In the case of 0.02% C the Mn content is 0.10–0.15% and the P content up to 0.07%.

The effect described can be increased, when blowing to steel, by again adding ore to the charge after the transition, that is in the dephosphorizing period, with the result that a considerable reduction of Mn and P is effected which in the finished steel leads to contents of 0.10–0.13% Mn and 0.02–0.05 P with 0.02% C, with a relatively smaller loss of iron from the bath than would be the case without this addition of ore.

If ore is added to a steel iron charge with a large lime addition, P is preferably oxidized in addition to Mn. If the ore is added to such a charge after the transition, the steel with a 0.02% C content has an Mn content of 0.4–0.5% and a P content of about 0.01–0.03%.

Ore therefore, in the case of highly basic slag, if added after the transition, accelerates preferably the oxidation of the phosphorus, whereas in the case of less basic slag, if added at the commencement of the charge or after the transition, the ore accelerates the burning of the manganese.

According to the invention all kinds of and desired intermediate analyses can be obtained in the first run metal, in the steel and in the slag by mutually varying the addition of lime, scrap and ore within and also beyond the anlysis values indicated, without affecting the scope of the invention, if the addition of lime, and/or of scrap and/or of ore is effected in stages during the course of the charge in order to change the influencing of the quantity and composition of metal and slag, same as of the temperature as desired within the widest limits which are technically possible. The favorable effect of cooling in stages for the production of uniform charge curves has already been described above.

In perfecting the steel iron blast process it has also been found that by tapping off a first run slag at a suitable time during the blasting process, which time may vary according to the local conditions, the slag quantity and concentration can be changed suddenly by introducing fresh additions which can also impart to the reactions an entirely new direction and intensity. This course is preferably chosen, if it is desired to obtain the slagged manganese at first in a state which is as valuable as possible for the production of ferro manganese or Spiegel iron, that is with the lowest possible percentage of SiO_2 and P_2O_5. In such an instance only a small amount of lime and scrap is added to the charge for example at the beginning, after about 3 minutes the slag rich in SiO_2 which is of no value is drawn off and the blowing is continued until the dephosphorizing commences, large quantities of scrap being added, that is at low temperatures, and with addition of but little lime. A slag is then obtained with 30–40% Mn; 35–45% CaO, 5–10% FeO and less than 0.5% P_2O_5. The metal produced by this process may be finish blown with a renewed addition of lime, but it is preferably used as duplex metal and finish converted in the Martin or electric furnace.

If the SiO_2 and P_2O_5 content are of no importance in the slag, and if it is mostly the metallic final product which matters, a considerable change can be produced in the composition of this final product by the process according to the invention for influencing a steel iron charge by tapping off the slag and changing the additions, as the two following examples show.

If, for example, a charge with a lime addition is blown up to a C content of 1.5%, and the slag formed up to this time with about 30–40% Mn; 40–50% SiO_2 and 10% MgO+CaO is tapped off, it is possible by continuing the blowing and by adding a small quantity of lime to obtain a finished steel with 0.5–0.7% Mn and 0.02–0.03% P. But if an ample quantity of lime is added at the beginning and the slag with about 40–50% CaO, 40–50% SiO_2 and 5–10% Mn is tapped after the blast has been on for about 3 minutes, and if after a fresh addition of lime with intensive scrap cooling the blowing is continued to a finish, a finished steel is obtained with about 0.2–0.3% Mn and 0.02–0.05% P and a slag with 40–50% CaO, 25–35% Mn, 5–10% SiO_2, 10–15% Fe and 1–2% P_2O_5.

It is evidently also possible to tap the slag before the burning of the phosphorus. The slag then has the following composition: 40–50% CaO; 30–40% Mn; up to 5% Fe and 5–10% SiO_2 and less than 0.5% P_2O_5 at which it would be suitable for the production of ferro manganese or Spiegel. The blowing of steel iron also resulted in an important and hitherto unknown discovery, i. e. that the iron of the bath only slags particularly strongly during the very last minutes of blowing. This discovery, however, renders it possible, according to the invention, to reduce losses of the charge thereby that during the blasting a first run metal or finished steel is blown only to a final manganese content of about 0.8%, a 1–1½% higher yield being then obtained owing to the slight loss of iron and manganese than occurs when blowing to 0.3–0.4% Mn.

The yield can be increased not only by this measure, but also by other measures coming within the scope of the invention. As has already been described it is possible, for example by increasing the addition of lime or by the hot working of the charge, (see Fig. 1) to protect the manganese from burning to such an extent that it burns substantially only after the transition. In this instance the loss of iron is evidently prevented to a far greater extent than if, as shown in Fig. 2, the working takes place at low temperature and with little lime. Furthermore, the loss of iron can, according to the invention, be considerably reduced by adding ore to the slag during the last minutes of blowing, a condition being that a quantity of CaO sufficient for the P_2O_5 combination must be present.

Another feature of the invention consists in providing during the blowing of steel iron measures which reduce the wear of the converter lining. Thus, it has been found that the wear can be kept relatively slight if, by adding cooling agents at intervals, the charge temperature is kept as low as the metallurgical condition for obtaining the desired final product will allow. It has also be found, that a steel pig iron with low Si content can be advantageously blown if the decomposition of the basic converter lining by the silicic acid formed has to be prevented. This discovery is new as regards the blasting of steel pig iron, as it could not be predicted that, in view of the high percentage of manganese in the pig iron and the manganese silicates which undoubt-

edly form, the silicic acid would attack the bases of the lining material. Investigation confirmed the fact known from the Thomas point of view that a high FeO content in the slag means considerable wear of the converter. It is therefore proposed, according to the invention, to interrupt the blast at a Mn content of about 0.8% wherever the purpose of use makes it appear advisable for the protection of the converter lining. By this means the wear of the lining is 25 to 35% less than when the charge is finish blown to 0.3–0.4% Mn.

The measures set forth above, and which are to be applied according to the invention when blowing steel pig iron or Bessemer pig iron containing phosphorus to first run metal or steel, may be employed singly or in any possible or desired combination without departing from the scope of the invention.

As the percentage of sulphur in the steel pig iron is mostly very low, it does not normally have any effect. But even a higher percentage of sulphur in the pig iron would be harmless because during the last minutes of blowing it would drop below the prescribed value.

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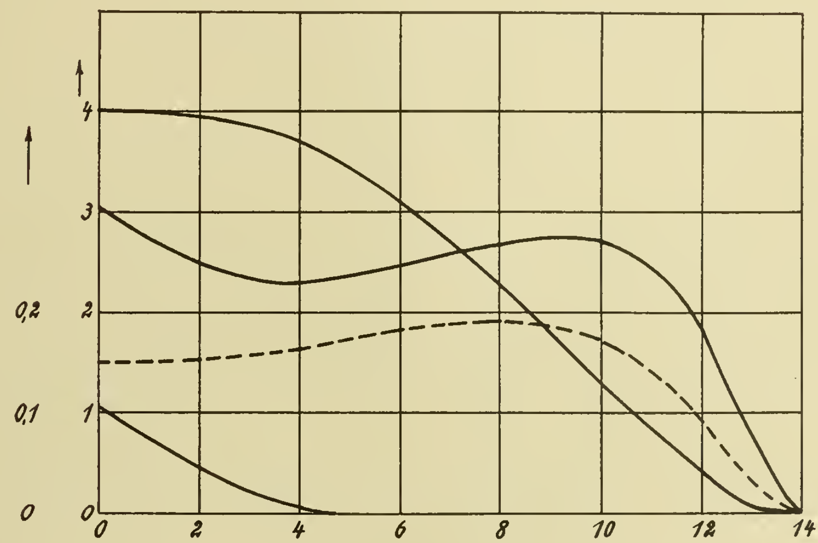
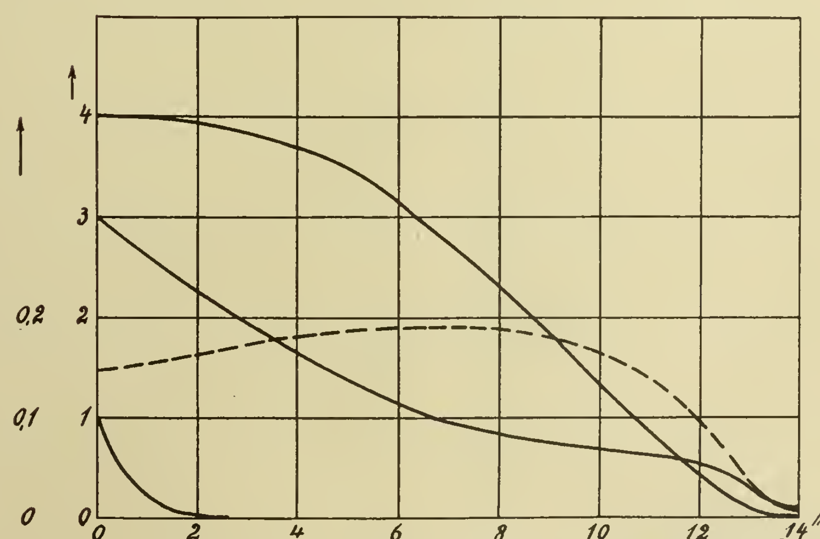
PROCESS FOR THE PRODUCTION OF FIRST RUN METAL OR STEEL FROM STEEL PIG IRON OR OF A BESSEMER PIG IRON CONTAINING PHOSPHORUS

Filed Aug. 7, 1939

Serial No. 288,900





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Published May 4, 1943 Serial No. 289,057

ALIEN PROPERTY CUSTODIAN

NON-RAVELLING KNITTED FABRICS

Karl Maier, Troyes, France; vested in the Alien Property Custodian

Application filed August 8, 1939

The present application, which is a division of my U. S. patent application Ser. No. 136,411, filed April 12, 1937, relates to non-ravelling hosiery and the manufacture thereof, and it is more especially applicable to articles made on a flat frame and more especially on a Cotton frame.

Various systems of interlocking the loops have already been suggested for ensuring a special connection between them and thus obtaining a practically non-ravelling article. But these suggestions involve serious drawbacks in that they permit of obtaining the desired result only to a limited degree because the articles knitted according to these methods no longer have the smooth aspect of ordinary knitted goods and lose the elasticity which characterizes knitted goods, or because the carrying out of these methods calls for a fitting of the frame with devices which are difficult to adapt to said rectilinear frames and in particular to the Cotton frame, whereby said methods cannot be used for practical purposes.

The knitted fabric according to the present invention is free from the first mentioned drawback in that it has a smooth appearance while keeping a satisfactory elasticity.

Furthermore, the manufacture of the knitted fabric requires but an easy modification of the frame. For instance the latter may be completed on the one hand by an auxiliary presser member, disposed parallelly to the usual presser member, which is kept without any modification in its form or its operation, on the other hand by a series of small blades or swinging parts disposed opposite each needle, between the latter and the usual presser member, said swinging parts being carried by the frame of the knocking over bits. Furthermore, the knocking over bits are subjected to a slight modification in order to create behind the existing throat a notch or second throat. This particular arrangement of the frame, which can easily be provided has not the above mentioned drawback and it permits a practical construction and use.

Among other methods suggested for the obtainment of a non-ravelling knitted fabric, it is known to make use of two yarns of different lengths, employed both in each course (that is to say in each horizontal line of loops). One of the yarns, the longer one, forms, on the outer face of the fabric, loops for all needles; and this in the usual manner. On the contrary, the second yarn, the shorter one, forms loops only on some needles, leaving a stretched portion from one loop to the other opposite the intermediate needles.

According to the present invention, the long yarn which is included in each course of loops is sunk and shaped in such manner as to constitute alternately, from one wale of loops to the other (the word wale designating the vertical lines of loops) a long loop extending over two successive courses of loops and a short loop formed on the first of the two above mentioned courses of loops. The short yarn is sunk in such manner as to constitute on the one hand a retaining loop for the long loop above mentioned and on the other hand in the next course a loop which is superposed to the short loop constituted by the long yarn.

In other words, the long yarn forms in each course alternately, a long loop and a short loop, and the short yarn forms, alternately, a loop which is jutxaposed to the short loop constituted by the long yarn and an ordinary loop which retains the long loop formed by the long yarn. It follows that the knitted fabric made according to this method has a connection not only in the horizontal and vertical directions but also diagonally, which has for its effect to eliminate the injurious action of a longitudinal pull exerted parallelly to the wales of loops, whereas the action of a transverse pull, that is to say along a course of loops is remedied by the double length of the long loops extending over two courses of loops. It is therefore clear that the article knitted according to this process cannot ravel at all, an advantage which is particularly advantageous in the case of stockings or similar articles.

It is clear that this system involves various embodiments. This results from the fact that the long loop formed by the long yarn can extend over any number of courses of loops, for instance three successive courses. Furthermore, it is possible to insert between the alternate courses of long and short loops (the long loops extending over two successive courses, a course of smooth short loops in which all the needles form short loops with a short yarn. In such an arrangement, I obtain a pattern similar to that of the Jacquard, the double loops (two juxtaposed loops), which project with respect to the simple smooth loops, forming patterns. Of course, instead of a single course of smooth loops, I may interpose a great number of courses of said loops, in such manner that other patterns appear on the right side of the knitted fabric.

Other features of the present invention will re-

sult from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described, with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 shows the back side of an ordinary knitted fabric.

Fig. 2 shows the back side of a knitted fabric manufactured according to the present invention.

Figs. 3 and 4 show, on the back side, modifications of knitted fabrics made according to the present invention.

Fig. 5 is a transverse section, on an enlarged scale, opposite a needle, showing the arrangement of the different members necessary for carrying out the present invention.

Figs. 6 and 7 are views, analogous to Fig. 5, some parts being in a different position.

Fig. 8 is a plan view of the auxiliary presser member.

Fig. 9 is a detail view of a knocking over bit modified according to the invention.

Fig. 10 is a perspective diagrammatical view showing how the elements shown by Fig. 5 are controlled.

Figs. 11 to 24 are diagrammatical views illustrating the different steps of the manufacture of the knitted fabric according to the present invention.

Fig. 20*a* is a view, corresponding to the position illustrated by Fig. 20, showing how the loops are engaged between successive bits.

Figs. 25 and 26 are diagrammatical views illustrating two different relative positions of the parts of the machine.

Adverting to Fig. 5, the drawings show the elements of a flat frame of the "Cotton type", to wit: the needle **1**, looping over bit **2**, knocking over bit **3**, presser member **4**.

According to the present invention, the frame is completed by a second presser member, or auxiliary presser **5**, and by a series of small blades or swinging parts **6**. Each of these blades is located opposite a needle and can pivot about axis **7** in the direction of arrow F under the action of the presser member **5** and against the action of spring **8**. The axis **7** is carried by the frame **7***a* of the knocking over bits.

The drive of the presser member **5** is obtained in the following manner:

Arms **9** (Figs. 5 and 10) connect presser member **5** to levers **10** keyed on a shaft **11**. This shaft **11** is subjected to the action of a cam **12** through the medium of the lever **13**, pivoted at **14**. This lever **13** is articulated at **15** to a link **16** which is pivotally connected at **18** to a lever **17** is keyed on shaft **11**, so that said shaft **11** is given a reciprocating oscillatory motion which produces the forward and rearward movement of the presser member **5**, which thus acts on blades **6** for tipping them in the direction of arrow F.

Shaft **11** is further subjected to a translatory movement in the direction of its axis, said movement being produced by the action of a wedge cam **19** acting upon roller **20**. This cam **19** is displaced vertically by the action of the cam **21**, fixed at 180° with respect to cam **12** on the same shaft **22**. The movement is transmitted through arm **23**, pivoted at **24**, connected through its end **25** with the link and lever structure **26**—**27**, articulated at **28**, lever **27** being keyed on shaft **29** and driving cam **30** in connection with roller **31** the support of which is connected through a link transmission **32**—**33** with the cam **19** capable of sliding in slideway **34**. A spring **35** ensures the return of shaft **11** and keeps roller **20** in contact with cam **19**.

Of course, the connection between shaft **11** and lever **17** is such as to permit the free sliding in the longitudinal direction of said shaft **11**.

A disc **36**, on which roller **37** runs normally, is juxtaposed to cam **21** and a suitable control permits of displacing lever **23** laterally for bringing roller **37** into a position in which it runs on cam **36**, in order to bring into action cam **30** and thus to produce the translatory motion of shaft **11**.

The control of roller **37** can be carried out as follows:

A lever **38** is pivoted at **39** and is connected to a shaft **40** at one of the ends of which there is pivotally mounted a bell crank lever **41**, pivoted at **42**. The arm **43** of this lever can be lifted by a boss **44** carried by an endless chain **45** which is given a suitable translatory movement.

As it will be readily understood, boss **45**, when meeting arm **43**, causes lever **38** to pivot against the action of return spring **46**, in such manner that roller **37** is brought into coaction with cam **21** (Fig. 10).

The auxiliary presser member **5** (Fig. 10) has its front edge (on the side carrying swinging members **6**) provided with teeth as it is visible on the plan view of Fig. 8. The pitch of these teeth is such that opposite the respective swinging members **6**, there is alternately a tooth **48** and a hollow **49**.

Swinging members **6** are each terminated, as shown by Fig. 5, by a nose **50** arranged opposite the usual presser member **4**. It is through these noses **50** that the needles are pressed, that is to say that the ends of their beards are driven into their eyes.

According to the invention, and in addition to the new members above described, the knocking over bits **3** (Fig. 9) are of particular shape in that they are completed by a throat **51**, provided behind the ordinary throat **52** and in line with nib **53**.

I have now described the structure of the frame capable of carrying out knitting according to the present invention. The following explanations will permit of understanding how said knitted article is made.

Adverting to Fig. 1, it is seen that in an ordinary knitted fabric the needle loops *a* are connected to one another merely by the sinker loops *b*, and this as well from one wale to the next one as from one course to the next one. If, in such a knitted fabric, a yarn is broken, for instance at *x* (as a result of a hole in a stocking or similar article), the lateral pull exerted in direction *c*, *d* (parallel to the courses of loops) and the longitudinal pull in directions *e*, *f* (parallel to the vertical wales of loops), these pulls being generally produced merely by the natural play of the muscles of the leg when walking, it is noted that the stocking ravels upwardly and downwardly, in directions *f* and *e*.

In order to prevent ravelling of a knitted article it is therefore necessary to eliminate or to render harmless both the action of the longitudinal pull (direction *e*, *f*) and the action of the transverse pull (direction *c*, *d*). According to the invention, this double result is obtained in the following manner, as shown by Fig. 2.

Considering yarn *g*, it is seen that, in the course, this yarn is shaped in such manner as to constitute at *h* a small loop, in the next wale

a long loop i and again a small loop h and so on, that is to say alternately a small and a long loop.

This alternative provision of small and long loops exists not only in the direction of the courses but also in the direction of the wales. For instance, it will be noted that yarn g^1 is shaped in such manner as to constitute a long loop i^1 in line with the small loop h and a small loop h^1 in line with the long loop i.

The small loops h or h^1 are formed by two yarns, to wit yarn g or g^1 and the yarn m or m^1, which further acts as retaining loop o or o^1 for the long loops i and i^1. Thus it is seen that the sinker loops k extend diagonally between each double loop, that is to say connect loops h to loops h^1. This arrangement of the sinker loops k has for its result to eliminate the action of the longitudinal traction or pull (direction e, f and the presence of long loops i has for its purpose to eliminate the detrimental action of the transverse pull or traction (direction c, d).

As a matter of fact, when a hole is made which causes a yarn to break the long needle loop i cannot slide through the short retaining loop o, which is located below it because yarn m, which constitutes this retaining loop o, undergoes at the same time a stretching due to the lateral elongation in direction c d and because no other expansion of long yarn g which constitutes the long loops i is possible, whereby a portion of long loop i, which is not subjected to a pull remains suspended in the short loop o, which has just undergone a stretching.

I have thus eliminated the detrimental action of the longitudinal pull or traction in direction e f on long loop i, which has now become free upwardly (direction f) due to the breaking of the loop in the preceding course, because the short yarn m, of which the short retaining loop o is made, said loop o being located below the long loop i that has become free, forms with the long yarn g, of which the long loop i is made, the short double loop h disposed directly adjacent as well as the long loop i as the short loop o disposed below the latter, the yarn m being consequently disposed diagonally. This diagonal connection causes the whole of the longitudinal pull or traction to act upon the short retaining loop o which has still a full connection and the short yarn m of which undergoes in fact no other longitudinal pull or traction in direction e, f, whereas the free long loop i is wholly discharged as a result of the excess of yarn it has with respect to loop o located under it and therefore remains suspended in loop o as if by a knot.

Fig. 2 also shows that, despite, the arrangement of yarns m and g, of different lengths, there can never be produced an excess of yarn projecting from the knitted fabric, and as well the long yarn g as the short yarn m are utilized for forming loops in all the wales in such manner that there exists in the knitted fabric no loose yarn.

Diagrams 11 to 24 illustrate how the above knitted fabric described with reference to Fig. 2, can be produced on a cotton frame.

On these diagrams I have shown two series of figures, on the one hand figures 11 to 17, on the other hand figures 18 to 24; the first series of figures shows the different steps of the manufacture of a wale of loops, for instance wale p (Fig. 2); the other series of figures shows, in correspondence with the first series, the same different steps for a wale of loops adjacent to the preceding one, that is to say for wale q.

Figs. 11 and 18 show the needle 1 of wale p and the needle 1a of wale q, supplied with the yarn m^1 which has just been distributed and has been shaped by sinkers 2. One sees on the knocking over bits 3 the loops of the preceding course that is to say (Fig. 11) the double hoop h and (Fig. 18) the long loop i.

The needles fitted with the yarn m^1 thus move down as shown by Figs. 12 and 19.

In an ordinary frame, in the course of this downward movement, the needles are all pressed, that is to say the beards of said needles, when meeting with the front edge of the presser member, are driven into the eyes of said needles, but it has been explained above that the frame is fitted with an auxiliary presser member 5 acting upon swinging members 6 and it was also explained that this presser member 5 is toothed and consequently acts upon every second swinging member.

It follows that, during the downward movement of the needles, only needle 1 will be pressed, as shown in Fig. 12, whereas needle 1a will move downwardly without being pressed (Fig. 19). Needle 1 is pressed as a consequence of the fact that presser member 5 (Fig. 5) has been given a forward movement in the direction of arrow F, this movement being produced by the action of the cam 12, Fig. 10.

The general view of Fig. 5 shows the elements of the frame when needle 1 is pressed by the action of the auxiliary presser member 5.

In the course of this downward movement, the yarn g, which constitutes the long loop i, penetrates under the beard of needle 1a and comes adjacent the yarn m^1, precedingly hooked (Fig. 20).

Fig. 20a shows the positions of the loops between two successive bits, in correspondence to the showing of Fig. 20.

On the contrary, as shown by Fig. 13, the double loop h has been normally knocked over on the yarn m^1 and in the supplementary throat 51, created for this purpose in the knocking over bits 3. Yarn m^1 thus forms the loop o^1 which will act as retaining loop for the long loop i^1 in the next course.

Needles 1 and 1a move back upwardly and come to hook the yarn g^1 serving to constitute the next course. This yarn g^1 is distributed in such manner that its length is greater than the length of yarn m^1 precedingly distributed.

Figs. 14 to 21 show the yarn g^1 locked in respectively by needles 1 and 1a after said yarn has been sunk by sinkers 2. It will be noted (Fig. 21) that yarn m^1 at the place of needle 1a is carried by the nib 53 of the bit 3, whereas the sinker loop of needle loop i is engaged in the usual throat 52.

In Fig. 14 it is seen that loop o is placed under the throat 52 of bit 3, this in the usual manner. The yarn m^1 (Fig. 21) has remained on the nib 53 as a consequence of the fact that no knocking over of the loop has taken place; it is maintained in this position by needle 1a.

Yarn g^1 being locked in by needles 1 and 1a, the latter move downwardly.

In the course of this movement, all the needles are pressed by the action of the ordinary presser member 4, which acts as shown by Fig. 7 on the nose 50 of each swinging part 6 (the comparison between Figs. 6, which shows the knocking over bit frame 7a in the position of rest, and Fig. 7, which shows this frame at the time of the action of the presser member 4, clearly shows this

action of pressing the needles bases place through the medium of the swinging members **6**.

Figs. 15 and 22 show the needles **1** and **1***a* when they have been pressed by the action of the presser **4**. It should be noted that this pressing action takes place only when the end or point of the beard of the needle has come a little below the upper ridge of nib **53**, in such manner that when the beard is pressed, the yarn m^1 (held by said upper ridge) has been caught in the beard; it is therefore locked in the same manner as yarn g^1 as shown by Fig. 22.

The needles further move downwardly and the preceding loop of every wale is knocked over, these preceding loops being loop o^1 for yarn g^1 (Fig. 16) and loop i for yarns g and g^1.

In the course of the knocking over movement, it is known that bits **3** are displaced with a translatory movement in the direction of arrow F^1 (Figs. 17 and 24).

In the course of this translatory movement of the bits, the throat **52** of said sinkers pushes in the direction of the arrow F^1 the course of loops precedingly established, that is to say the short loop o^1 (Figs. 16 and 17) and the long loop i (Figs. 23 and 24).

As it will be readily understood, this translatory displacement of the bits **3** differently bends needles **1** and **1***a*. As a matter of fact, needle **1**, which has locked in only the yarn g^1 distributed in a loose manner, pulls on this yarn and forms a long loop i^1 (Fig. 17), while needle **1***a*, which has locked in at the same time the yarn g^1 distributed long and yarn m^1 distributed short, is driven by the latter and as a consequence of this traction and due to its flexibility said needle is brought into the position shown by Fig. 24.

The excess of long yarn g^1, distributed opposite needle **1***a*, is therefore absorbed and permits consequently the formation of the long loop i^1 on needle **1**.

As a result of the translatory displacement of the knock over bits, the yarn g^1 is therefore suitably distributed and stretched on the needles **1** and **1***a*, as shown by Fig. 2, and the loop of yarn g^1, which constitutes the double loop h, is of the same length as the loop of yarn m^1, which also constitutes the double loop h. In the next course, the cycle is repeated but the needles **1***a* will work in the manner above described with reference to needles **1** and the latter will work in the manner above described with reference to needles **1***a*.

This change of function of the needles is determined by the action of the presser member **5** which is displaced in the direction of its longitudinal axis, as above explained, by the action of the cam **21** and of cam **19**. The length of this displacement is of course equal to the width of the teeth **48** of presser **5** in such manner that said teeth instead of being located opposite the needles **1** are now located opposite needles **1***a*.

Fig. 26 corresponding to a position of the parts intermediate between the positions of Figs. 15 and 16, or 22 and 23, shows how the needles, during the return movement of the looping over bits **2**, bring the long yarn g^1, caught under their beards, on the front upper face **54** of the knock over bits **3**. The preceding loops o or i which surround the needles are thus knocked over on the yarn g^1. Upon the next forward movement of the knock over bits **3** (in the directions of arrows F^1) the loops i formed by yarn g^1, or the double loops h, are caught in the groove **52** of the knock over bits, as shown by Figs. 15–16–17–22–23–24.

Fig. 25 shows how the needles, during the return of the looping over bits **2**, bring the short yarn m^1, caught under their beards, above the nibs **53** of the knock over bits **3**, after which, in the case of all the even numbered needles, to wit needles **1** in the drawings, the double loops h surrounding the needles are knocked over in throats **51** on said short yarn m^1, so as to form the short loops e, whereas, in the case of all the odd-numbered needles, to wit needles **1***a* in the example illustrated by the drawings, the loops formed by the short yarn m^1 are associated with the long loops i which surround said last mentioned needles, under the beards thereof, as shown by Fig. 20.

According to applicant's invention, this knocking over of the loops, alternately in front, and behind, the nibs **53** of the knock over bits **3**, that is to say in throats **52** and **51**, respectively, is obtained by providing on shaft **22** (Fig. 10), from which the horizontal movement of the knock over bits is transmitted two eccentrics located side by side and capable of ensuring different respective movements of said knock over bits **3**, there eccentrics being alternately brought into play according to which course of loops is going to be formed, through a mechanism such as that shown by Fig. 10 for pushing rollers **37**.

According to applicant's invention, the alternate pressing action, once on all the needles and the next time on only one half of these needles, is also obtained by providing side by side on shaft **22** two pressing control eccentrics of different size and position, these eccentrics being alternately brought into play through a mechanism of the type above referred to.

Such an arrangement permits of obtaining that the needles, during the formation of the course of short loops of yarn m^1, remain at a certain distance from the pivoting blades **6** adjacent to presser **4**, whereby the blades **6** which are located opposite a tooth of auxiliary presser **5** exert a pressing action on the corresponding needles only at the time of the forward displacement of presser member **5** (Figs. 5 and 8), whereas, when working the course of loops formed with yarn g^1, the needles, as shown by Fig. 7 are pushed frontwardly toward the pivoting blades **6**, which bear upon member **4**, so that all the naadles are pressed. The supplementary member **5** is thus brought out of action.

Fig. 3 shows, seen on the back side, an nonravelling knitted fabric which can be obtained according to the present invention.

As shown by this figure, it is possible to choose the arrangement of the yarns in such manner that the needle **1** of the wale p, after having formed the double short loop h, as shown by Fig. 2, that is to say with yarns m and g, forms a loop **1** with yarn n distributed a little longer than yarn m, but shorter than yarn g, whereas needle **1***a* of course q is not pressed and thus forms a loop which will be knocked over at the same time as the long loop i of the file q on the double loop h^1 constituted by yarns m^1 and g^1. With this arrangement, the long loops i are, as clearly shown, longer than the loops i precedingly obtained as shown by Fig. 2.

Fig. 4 relates to another embodiment of nonravelling knitted fabric in which there is interposed between the long loop i and the double short loop h (Fig. 2) a smooth course of simple loops.

This knitted fabric is obtained in the following manner: After having made loop h on the needle

l of file *p*, I distribute a short yarn *r* with which are formed short loops, as shown at *s*, and this for each file *p* and *q*.

Then I distribute the yarn m^1, as shown by Fig. 2, and a new long yarn *gl*, and so on.

In such an arrangement, I obtain a pattern similar to a Jacquard pattern as a consequence of the fact that the double loops *h* project, with respect to the smooth loops *s* and o and thus forms patterns. Of course, it is possible to introduce at will a great number of courses of simple loops by distributing yarns *r* over as many courses at it is desired, in such manner that other patterns always appear on the right side of the knitted fabric.

It will be readily understood that it is possible to make knitted fabrics according to any desired arrangement and in particular according to those illustrated by Figs. 3 and 4, with the elements above described, with reference to Fig. 5 and Fig. 10. As a matter of fact, the looping is a function partly of the movement of the auxiliary presser member **5** and this movement can be modified at will through the action of cams **12** and **21**, which can be brought into play at the proper time.

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BY A. P. C.

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289,057

8 Sheets-Sheet 1

Fig. 1

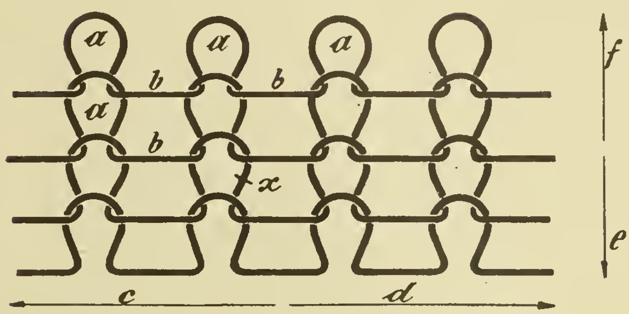

Fig. 2

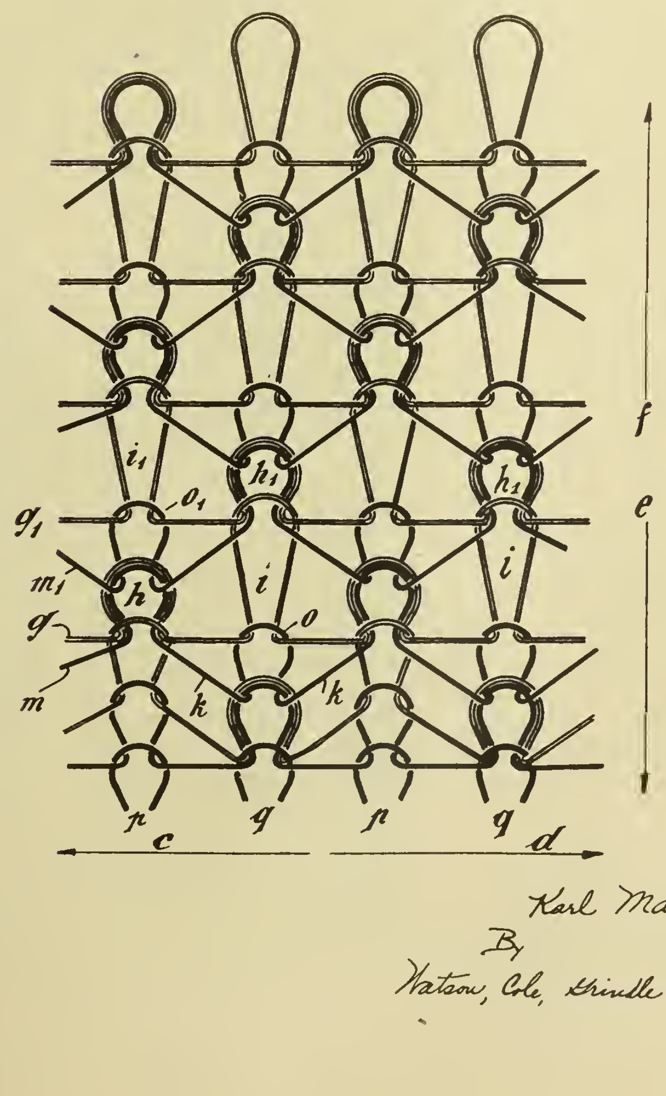

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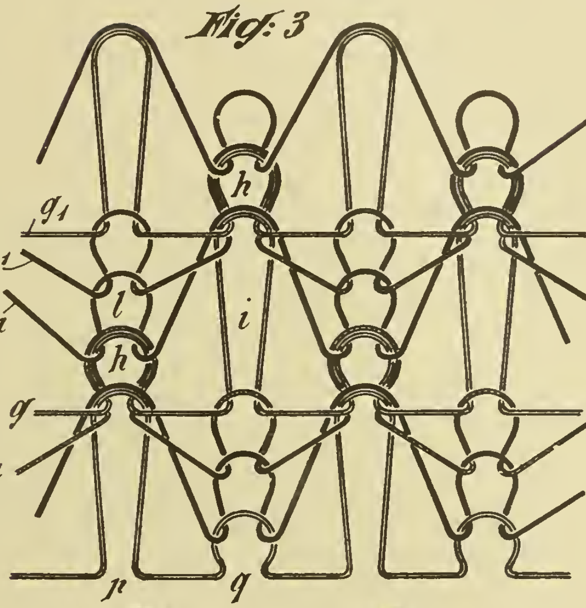
Fig: 3



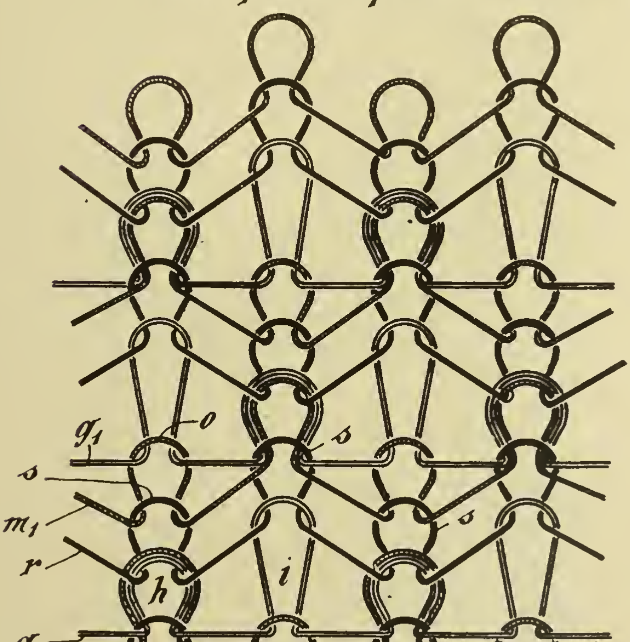


Fig: 4

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Fig: 9

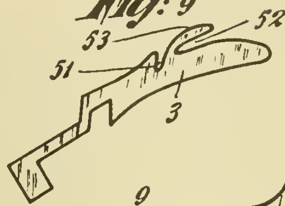

Fig: 5

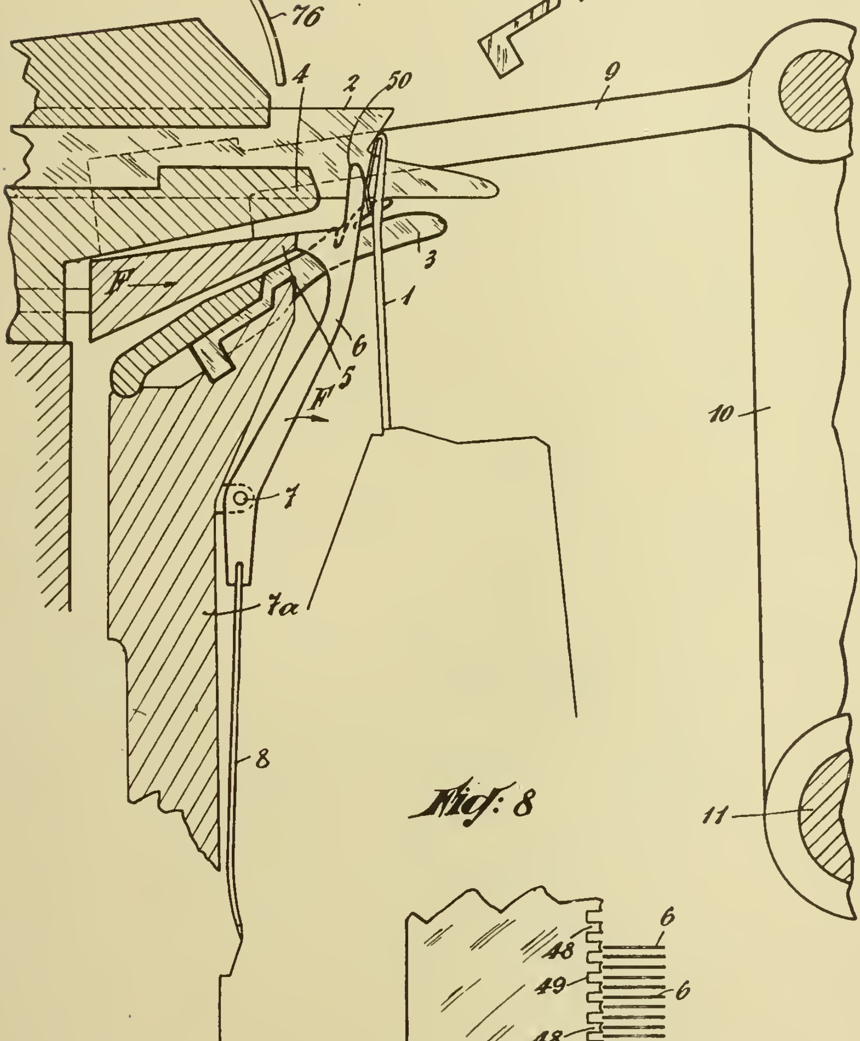

Fig: 8

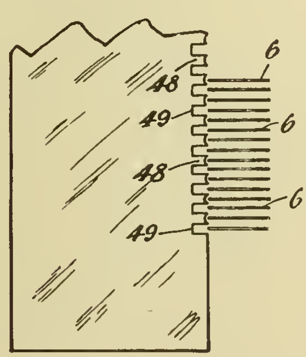

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Fig: 6

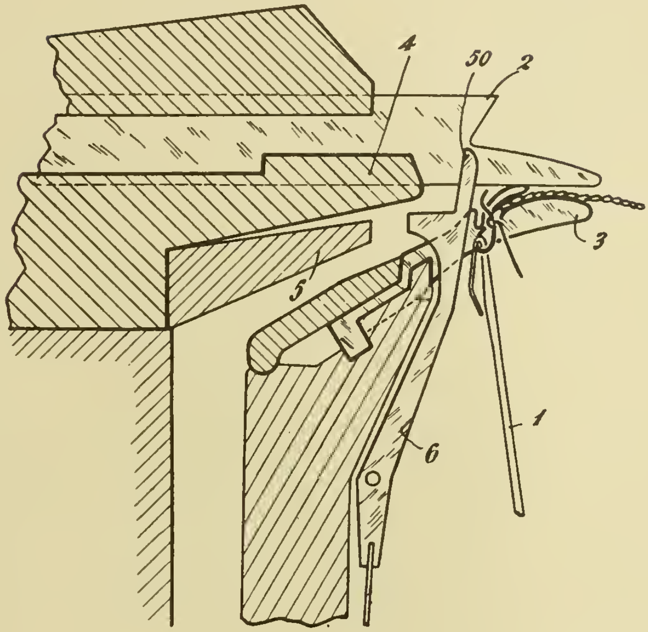
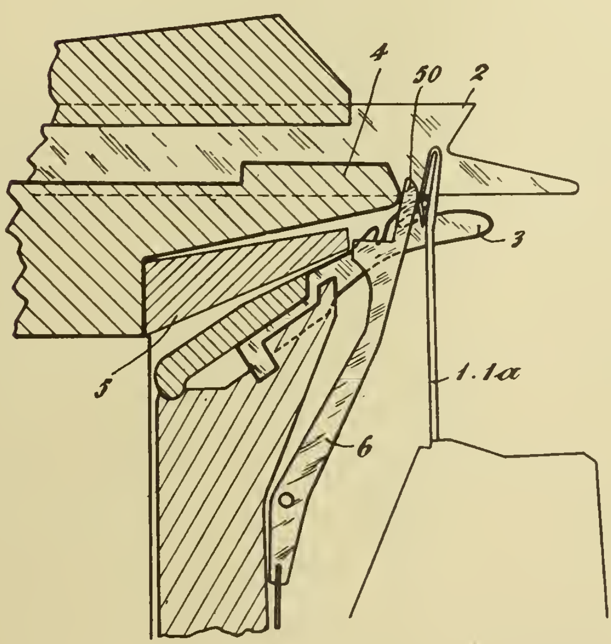


Fig: 7



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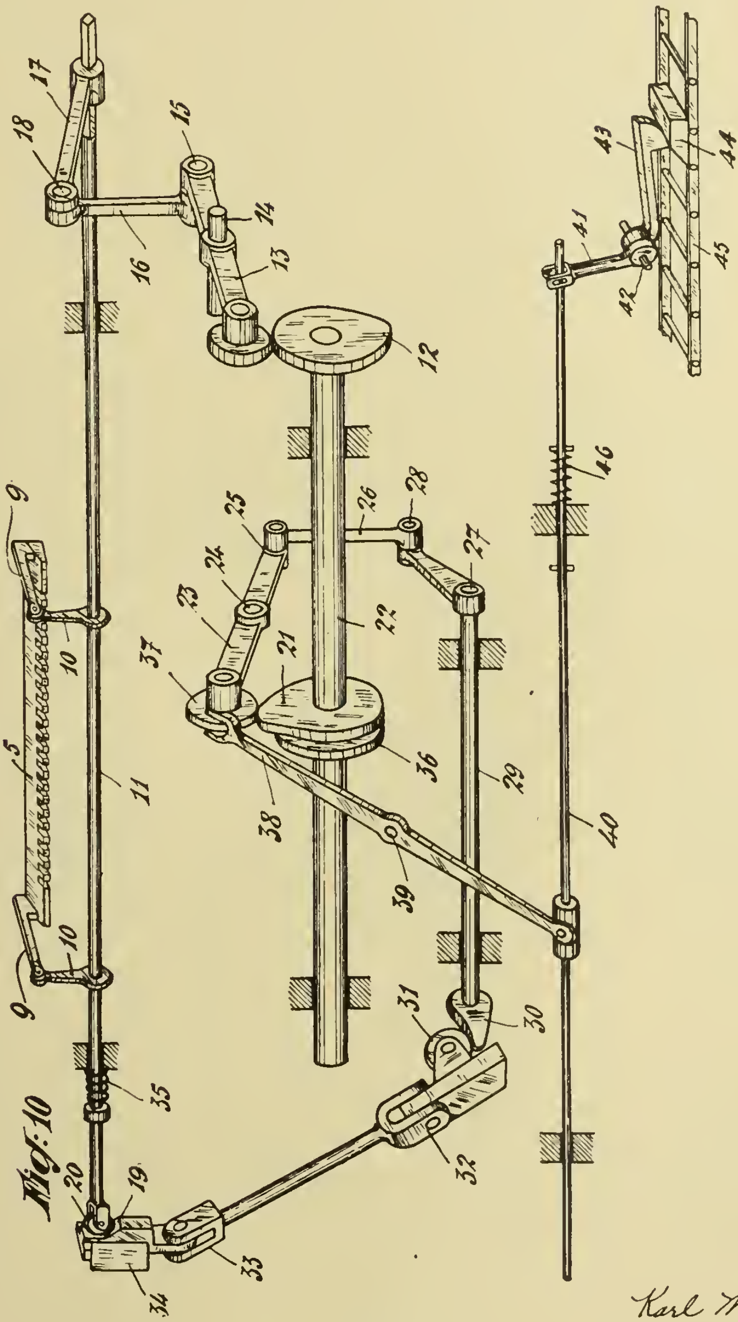

Fig. 10

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Fig: 11

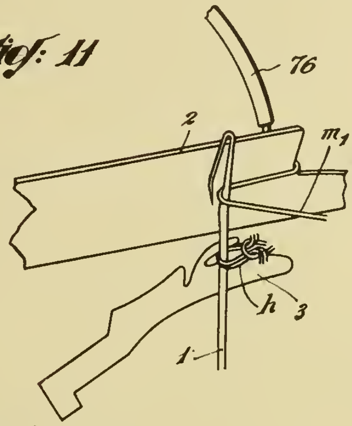


Fig: 18

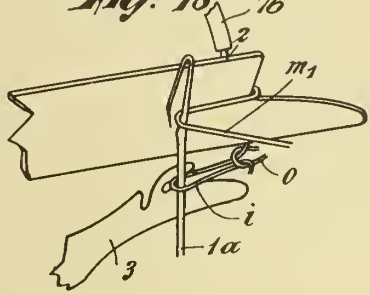


Fig: 12

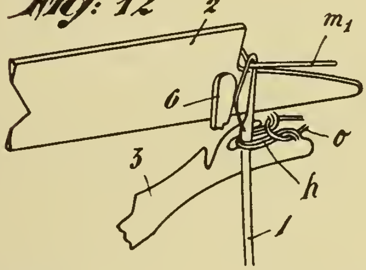


Fig: 19

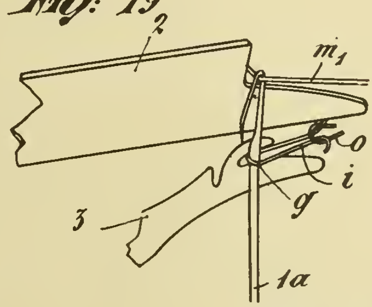


Fig: 13

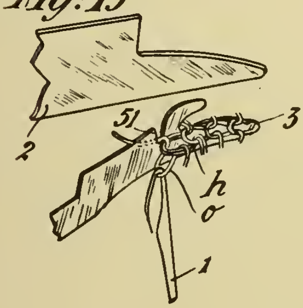


Fig: 20

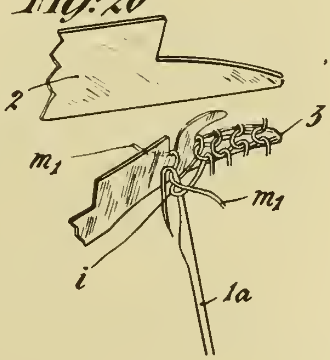


Fig: 20a

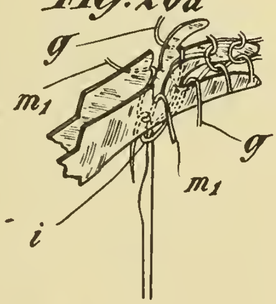
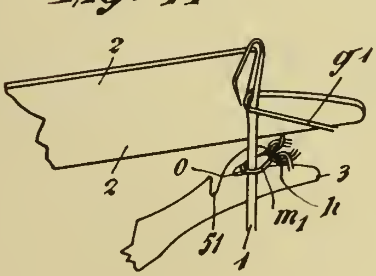


Fig: 14



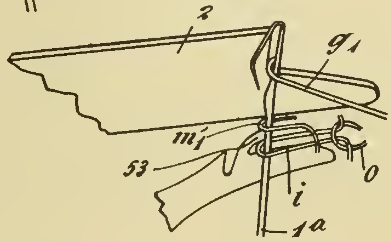


Fig: 21

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Fig: 15

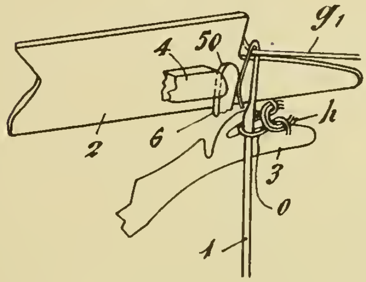

Fig: 22

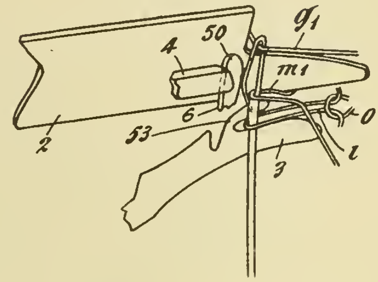

Fig: 16

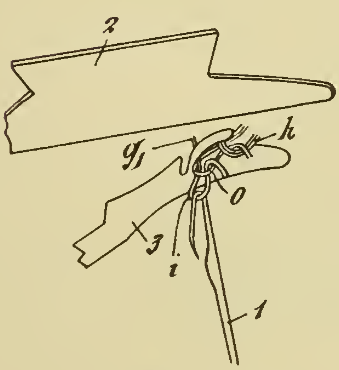

Fig: 23

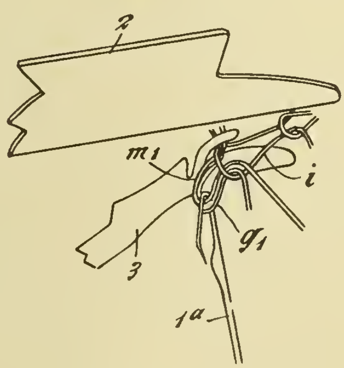

Fig: 17

Fig: 24

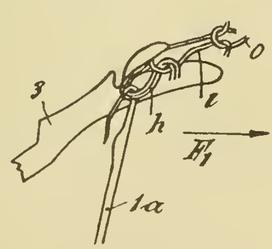

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Fig: 25

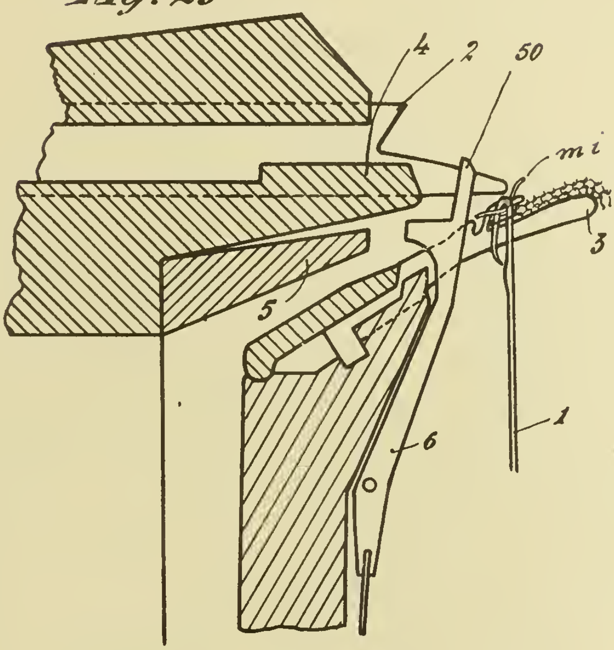
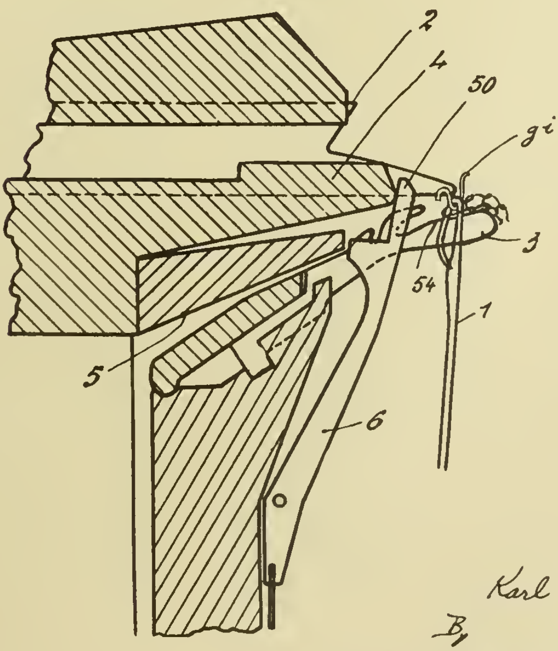


Fig: 26



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ALIEN PROPERTY CUSTODIAN

METHOD IN MEASURING HEAT CONSUMPTION

Oscar Constantin Brun, Copenhagen, Denmark; vested in the Alien Property Custodian

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The consumption of heat from radiators and hot-water-cocks in heating plants is ordinarily measured by evaporation of a liquid from containers disclosed in meters, which are arranged at each individual heat delivering member of the heating plant so as to be heated from the said member in question.

Ordinarily the said liquid is tetraline, because the boiling point of this liquid is sufficiently high and because the evaporaton characteristic of tetraline has a form which within the ranges of temperatures coming into consideration by measuring heat delivered, for instance from radiators, corresponds nearly to the form of the characteristic curve of heat delivery of a radiator.

Now heat measuring meters of the said kind have a considerable non-load evaporation, which means that even if no heat is delivered from the heating plant the meters would nevertheless record a consumption, viz. the said non-load evaporation, due to the fact that at ordinary room-temperature a considerable amount of the measuring liquid, viz. tetraline, would evaporate. This causes an incorrectness of the result of the measure, and this incorrectness is rather considerable and may amount to 25–50% of the recorded consumption. For this reason the recorded amount of heat cannot be relied upon as a base for the calculation of the share of the individual consumers in the total heat consumption from the heating plant.

It has been proposed to remedy this drawback by fitting the measuring scale of the meter with means for compensating the non-load evaporation in dependence of the time in which the meter has been in use before the registration is read. In this way it is however not possible to secure a sufficient correctness of the measuring, because the properties of the tetraline, and specially the speed of evaporation of tetraline change gradually due to the influence of air and heat, and probably also due to the influence of the light, so that gradually the speed of evaporation of tetraline decreases and this influences the registration of the consumption of heat to a detrimental degree.

One object of the present invention is to avoid the incorrectness of the measured consumption due to non-load evaporation of the measuring liquid, and a further object of the invention is to avoid the incorrectness of the registered consumptions, which is due to changes of property of the measuring liquid. To this end there is according to the invention used measuring liquids other than tetraline, decaline and similar liquids.

According to the present invention the purpose aimed at may be obtained by the use of a measuring liquid, having a speed of evaporation, which is very slow at ordinary room-temperature, or by use of a measuring liquid, which from the air slowly absorbs humidity to such a degree, that the amount of humidity absorbed in the course of a certain interval of time by the measuring liquid is less than twice the amount of the said liquid, which at ordinary room-temperature would evaporate in the course of a corresponding interval of time.

A measuring liquid of the first mentioned kind is according to the invention an octylic alcohol, for instance normal secondary octylic alcohol, and a proper measuring liquid absorbing humidity from the air is according to the invention a higher, absolute alcohol.

If the measuring liquid absorbs from the air an amount of humidity less than twice the amount of liquid, which simultaneously disappears due to non-load evaporation, then this absorption would cause a relative increase of the volume of the liquid contained in the meter, so that the observed descent of the surface of the liquid in the container of the meter would correspond not to the amount of liquid, which has evaporated, but to the difference between this amount of liquid and the volume of humidity absorbed from the air.

It would be obvious that, if this amount of liquid is less than twice the amount of the measuring liquid evaporating at ordinary room-temperature, say about 68° F., the deviation of the registered consumption read on the measuring scale of the meter from the correct consumption would numerically be less than the incorrectness caused by the non-load evaporation.

Hitherto experts in the art have been of opinion that hygroscopic liquids are not applicable as measuring liquids in meters for measuring heat consumption by evaporation of a liquid, but this consideration may now be considered to be incorrect, because a hygroscopic liquid, which fulfills the above mentioned requirement with respect to the amount of humidity absorbed from the air, and further has a boiling point of a proper high value, for instance 300 to 400° F. and a proper characteristic curve of evaporation would be applicable for the said purpose. Such liquids are certain higher absolute alcohols and especially hexaline.

Hexaline would, when used as a measuring liq-

uid in methods of the above mentioned kind absorb humidity from the air independently of the temperature and the degree of humidity of the air, so that in a certain period of time hexaline would always absorb a constant amount of humidity, substantially independently of the air condition.

It has been observed that the evaporation of hexaline when influenced by the heat to be recorded would not vary to any considerable degree with the contents of humidity in the hexaline, and further the amount of humidity absorbed for instance in the course of a measuring season would be less than the amount of hexaline, which in the course of the measuring season would evaporate at ordinary room-temperature. The absorbed humidity would therefore partly compensate the incorrectness, which is due to the non-load evaporation, since the absorption would cause an apparent reduction of above 50% or the more of the non-load evaporation. For this reason more correct registrations are read on the measuring scale of the meter. Preferably hygroscopic liquids should be used, which besides of fulfilling the above conditions have a melting point, which lies between the lowest temperature at which the heat delivery member in question should operate and the lowest room-temperature, viz. 50°F. at which radiators are ordinarily not taken into use.

Hexaline has this property, since hexaline is a solid material at ordinary room-temperature and would maintain its solid state as long as hexaline has not had the occasion to absorb humidity. Hereby the advantage is obtained that by the use of hexaline as a measuring liquid in meters of evaporation fitted with a wick the hexaline would not be able to ascend the wick to the top end of same, from which the evaporation takes place, before the hexaline has been exerted to influence of heat. Therefore, a meter, which is supplied with hexaline a shorter or longer time before the commence of the heating season would practically not have a non-load evaporation and would not absorb humidity—which might cause an elevation of the surface of the hexalin in the meter, in which event the later registrations would not be correct—before the hexaline is heated.

In a heating plant comprising radiators as well as hot-water-cocks it would be advisable to measure the heat consumption by way of meters of the above mentioned kind by using hexaline as measuring liquid in the meters arranged to measure the delivery of heat at the hot-water-cocks, whilst normal secondary octylic alcohols are used as measuring liquids in the meter arranged at the radiators. If so the advantage is obtained that on all of the said meters there may be used measuring scales of the same species and of the same length, and if the meters are fitted with wicks the dimensions of the wicks in all of the meters may be equal. It would be obvious that this is advantageous.

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ALIEN PROPERTY CUSTODIAN

METHOD FOR HOMOGENEOUSLY COMBINING BASE MATERIALS OF ALL KINDS WITH NITRO VARNISH AND COLOR FILMS

Max Robitschek, Stuttgart, Germany; vested in the Alien Property Custodian

No Drawing. Application filed August 22, 1939

The decorative surface of plates, slabs and bodies of natural wood, plywood, pressed fibre masses with various compositions and made according to various methods, press spahn, tarred felt, hard cardboard and similar artificial materials is formed with the use of color or varnish films in one or several operations, in one or several shades according to the decoration required, and also in profiling the otherwise plane surface, similar to leather grains and the like. These different methods are open to the objection that the color or varnish films applied according to the known methods while possessing good adhesive properties do not enter into intimate combination with the base material and, as foreign bodies on the base material, are consequently detachable under mechanical, chemical and atmospheric influences.

In the case of base materials saturated with grease, tarred or made from artificial resin the necessary preparation is a very expensive process which frequently jeopardizes their economy.

The present invention is based on the consideration that the base material and surface coating are continually subjected to different volumetric changes. For the color or varnish film to be applied an approximating substance or compensating substance has been discovered, which adapts itself to the base material in every dimensional body change. This method ensures the homogeneous combination of base material and color or varnish film.

According to the invention a shellac or gelatine solution serving as binding medium is applied on to the surface of the base material in known manner and, when this medium has dried, a color or varnish film is applied, whereupon the base material provided with these layers is finally hot pressed. The shellac or gelatine solution is applied thereby with the result that the varnish or color film enters into intimate combination with the base material so that the color or varnish film cannot become detached from the base material under mechanical, chemical or atmospheric influences. The binding layer is so thinly applied that, after liquefaction, it is completely taken up in the base material and the nitro varnish or color film so that this film is absolutely permanently united with the base material. A softening or a hardening agent may be added to the binding layer according to the character of the base material and imparts the desired flexibility or stability to the base material. In this manner a leather-like flexibility, grooving or folding resistance or a complete surface stability may be imparted to the product. This last mentioned property is particularly important and economical for certain purposes of use for which wood glued with copal, was hitherto employed. The binding layer may also consist of a colorless or suitably colored gelatine. Moreover, the base material may be coated with the binding layer on one side or on both sides according to the purpose for which it is intended.

The following is an example of the way in which the method may be carried out:—

The base material, irrespective of its nature and composition, is first provided on one side or on both sides with the above mentioned binding layer composed of a twenty percent solution of gelatine or of a ten percent solution of shellac. The drying out of the solvent used for the binding layer is effected at a temperature of about 70 to 80° C and takes about 1 to 2 hours. This gelatine or shellac film applied with the addition of known softening or hardening agents and by a rolling, spraying, immersion or other process, represents a kind of artificial epidermis and serves at first for anchoring the protecting film to be applied on to the back and of the color film of finely pigmented nitro cellulose varnish to be applied on to the front of the base material. The front grain film may be made in any thickness between 0.1–0.5 mms and even more according to the requirements of the base material and the stressing which the finished product has to withstand.

The converting of the epidermis layer into a flux intimately connecting the base material with the color or varnish film is effected by a subsequent operation, using a predetermined pressure and a predetermined temperature according to the requirements of the base material. In the same operation the surface of the grain film can be finished in smooth or in any desired ornamental form by using smooth or correspondingly engraved pressure plates or rollers and in one or several stages.

MAX ROBITSCHEK.

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ALIEN PROPERTY CUSTODIAN

HEAT CONDUCTING FIBRE BOARD

Hermann Basler, Berlin, Germany; vested in the Alien Property Custodian

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This invention relates to composition fibre boards and the method of their manufacture and particularly to heat-conducting fibre boards for structural purposes.

Heretofore metal impregnated heat-conducting composition boards have been made by mixing metal pieces or particles into a mash consisting of organic or inorganic fibres and a suitable binder such as synthetic resins, oxidizing oils, pitch, etc. However, I have found that a useful metal impregnated product can be made without the use of such binders; and it is an object of this invention to provide a new heat-conducting composition fibre board product having an uninterrupted metallic skeleton uniformly distributed throughout its mass, which product will be stronger than fibre boards heretofore produced and yet of less weight per cubic unit. Other objects of this invention are to provide a cheaper metal impregnated fibre board and to provide a simplified method of making the same.

In practicing my invention I first produce a semi-liquid mash of water and fibres, either organic or inorganic, such as is done in the known manner for making such products as Masonite, Insulite, Beaverboard, Celotex and other such well-known materials. I vary the usual procedure for such products however, by mixing into the mash shredded, ground, or otherwise divided, broken-up or comminuted metal pieces such as aluminum, iron, copper, or other suitable metals, and I stir or otherwise mix a sufficient quantity of such metal pieces into the mash until the metal particles are substantially uniformly distributed throughout the entire mash mass, so as to provide an uninterrupted metal skeleton imbedded in the material, the consistency of the mash being maintained like a thick mush so as to hold the metal pieces in suspension therein and prevent their settling out. I then mold this metal impregnated mash into board, sheet or slab form in any of the several well-known methods for forming composition fibre board, such for example as that disclosed in my United States Patent No. 2,095,118, during which most of the free water or moisture is removed from the material and after which the board or sheet is dried in the usual manner.

The result is a heat-conducting fibre board having an uninterrupted internal skeleton of metal woven throughout its mass and extending from face to face of the board so as to greatly enhance its strength, durability and heat-conductivity and yet having a mass weight that is considerably less than heat-conducting boards heretofore produced. Furthermore, my improved heat-conducting fibre boards have the softness or yieldability of the usual composition boards used for insulating purposes and are thus to a great extent sound absorbing.

Formerly it was believed necessary to employ a synthetic resin or other suitable relatively heavy binder in the mash mixture, whenever metal particles were to be added or mixed in, in order to fix the metal pieces and give solidity to the board body. This necessity I have eliminated. I may in some cases, however, employ a suitable sizer in the known manner to improve the waterproof qualities of the material and it must be understood that in this respect the sizing that I may employ is not a binder. Sizing is a waterproofer only, and may be omitted; and though, when used, it might serve to a minor extent as a binding agent, that function is only incidental and is not its primary purpose.

The main advantages of my improved produce reside in the lower cost of manufacture and in the simplification of the manufacturing process through the elimination of heavy, relatively expensive binding agents. Other advantages are found in the comparatively lighter weight of the product and in the increased strength and durability thereof as compared with ordinary fibre boards such as those before mentioned. Also, my improved heat-conducting boards may be made in thin, light sheets without material sacrifice of strength and durability.

Among the many purposes of my improved product is its use as flooring or wall boards and particularly its use in certain modern arrangements for heating and air conditioning occupied spaces. The heat conductivity of the material permits its use as a heat radiating medium thus allowing wall constructions wherein a heating or cooling means is enclosed within the wall and the outer wall surface serves as the heat radiating and distributing means. Also walls may be constructed of this material which walls of themselves, serve as ducts for passage therethrough of a heating or cooling medium. Similarly the material may be used for flooring and for ceilings and for the floor boards of automobiles, etc. Any desired color or surface finish may be imparted to the material and as flooring, the metal skeleton greatly reduces wear.

The conductivity of the improved material depends mainly upon the amount of metal used to form the internal skeleton and may thus be varied to suit various uses or conditions. In any event, however, sufficient metal must be employed so that the metal pieces will contact each other to provide an uninterrupted skeleton extending from face to face of the board or sheets. The particular metal used will depend also upon the manner and conditions of use of the improved boards, aluminum for light weight and low cost; copper for high conductivity, etc.

Also the improved boards or sheets are readily adaptable as electric conductors and may be used as electric heating elements.

HERMANN BASLER.

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ALIEN PROPERTY CUSTODIAN

TREATMENT OF YARNS

Fritz Drechsel, Kufstein/Tyrol, Germany; vested in the Alien Property Custodian

No Drawing. Application filed August 26, 1939

This application is a division and continuation in part of my copending application Ser. No. 245,791 of Dec. 14th, 1938, and refers to the treatment of yarns with cuprammonium cellulose solution. More especially the invention refers to the use of such cellulose solutions which are readily fluid. Ordinarily the solutions of cellulose within copper-oxide ammonia are rather thick like a paste or a syrup; in contradistinction thereto according to my present invention cuprammonium cellulose solutions are used of a fluidity like machine oil at ordinary (room) temperature, that is a viscosity of about 500 to 3,500 and preferably between 700 and 1,700 on the Saybolt scale.

The fluidity in question can be obtained in different ways, for instance by a protracted stirring of the solution, preferably in the presence of oxygen or an oxygen containing gas like air, or by means of an increased content of ammonia or by a reduced content of cellulose or by a number or all of these steps. I prefer, however, a two step process in which firstly a paste-like solution with about 8% air dry cellulose that is about 7.2% totally dry cellulose is manufactured which is then diluted with aqueous ammonia to the consistency of machine oil and a cellulose content of 3 to 4% calculated on totally dry cellulose. A mixture of equal parts of concentrated ammonia solution of the specific weight 0,930, and of water is a suitable solution for diluting. I found that this method provides a cellulose solution which is very useful for the purpose in that it has the suitable fluidity and can readily be stored and managed without spontaneous decomposition and its cellulose remains relatively unattacked.

Suitable copper sources are all the neutral and basic copper salts or copper hydrate. I, however, prefer solutions of neutral copper sulphate in aqueous ammonia to which alkali hydroxide for example soda lye is added in a quantity approximately sufficient to transform the copper sulphate present in the solution to copper hydrate. The amount of the ammonia in the first solution calculated as pure NH_3 may be approximately or near half the quantity of the copper sulphate in the form containing water of crystallisation.

Any source of cellulose may be used for instance wood cellulose, cotton and cotton linters, but I prefer to use waste of vegetable fibres for instance the waste fibres obtained in teasing or shearing fabrics, or the waste in spinning mills. Such waste has the character of dust and consists of very short cut or torn cellulose-fibres or fragments thereof which are practically worthless but which I found very suitable since the fragments of fibres dissolve more easily than the intact fibres.

The waste may be bucked and/or bleached to remove dirt, size and undesired colour.

The mixture of the ingredients mentioned above is well cooled preferably to about the freezing point but not beneath $-10°$ C, and stirred and kneaded until a homogeneous mass is obtained which can be stored at will, and diluted with aqueous ammonia before use as herein before described. The quantity of cellulose should be preferably so calculated that the copperoxide ammonia present in the solution is entirely or approximately saturated with cellulose so that the solution has practically no etching properties.

With this diluted solution I impregnate threads or yarns consisting of vegetable or artificial fibres, but remove the excess solution from the threads or yarn. This removal should be as complete as possible since the interstices between the individual fibres in the yarn should be kept empty to avoid adhesion of the fibres as far as possible, and to retain the filling and covering power of the yarns. This can be secured by squeezing or centrifuging or by other mechanical methods which are well known in the art for removing an excess of a readily fluid material, so that the single fibres are merely coated by a thin film of cellulose solution. Then follows a treatment with a precipitating medium like water, alkali lye and the like, say soda lye from 4 to 20° Bé, and subsequently with a decoppering solution like an acid salt or an acid for example diluted sulphuric acid, e. g. from 2 to 15% H_2SO_4. Precipitation and decoppering may also be performed by one and the same suitable substance in a single process; diluted acids preferably sulphuric acid are suitable media for this purpose. I found that precipitation by a medium which is not acid, and decoppering with an acid substance provides a lustrous product, whilst the one step process in which precipitation and decoppering is obtained at once by a single acid solution, provides a mat product.

The decoppered yarn is neutralised, washed and dried in usual manner.

The yarn can be of any kind and in any form. The term "yarn" comprises every article of mainly one-dimensional extension which is composed of fibres or filaments arranged about lengthwise, and twisted together by a variable twist. The term "yarn" includes therefore ordinary yarns and threads as well as slubbings, rovings and similar intermediate stages of the spin-

ning process. The fibres or filaments may consist of natural cellulose, or of cellulose regenerate or derivative in the case of artificial threads or of mixtures thereof. The individual threads or filaments may be short (in the case of vegetable fibres or artificial wool) or practically endless (in the case of rayon).

The yarn can be loose in the form of hanks and the like, or may be wound in the form of bobbins, cheeses and the like.

By my process the individual fibres do not stick together so that, in the case of rovings or slubbings, the drawing and spinning process is not impeded, and, in the case of yarns, they retain their filling and covering power. The products treated according to my invention, get a pleasant and durable touch. If the fibrous material consists of cotton, the treatment increases the dyeing capacity more particularly in respect of substantive or vat dyes. Yarns of cellulose derivatives e. g. cellulose ester or ether are altered by the treatment in such a manner that they can be dyed with ordinary dyes which go on cellulose.

If fibres of regenerated cellulose or cellulose derivatives or mixtures of natural (vegetable) fibres with fibres of regenerated cellulose or cellulose derivative are treated in yarn form, the artificial fibres receive an increased resistance with respect to certain solutions employed in subsequent treatment. Thus for example yarns of artificial fibres alone or in mixture with other fibres are less damaged by bucking and bleaching if they are pretreated according to my invention than if the raw fibrous material were subjected to bucking and bleaching.

Particular advantages are obtained in treating warps. This process may be performed continuously while winding on the warp on the beam.

The warp is wound off from another beam or directly from the warp bobbins and led through the different solutions mentioned above, and finally dyed, before winding on the warp beam. The removal of the excess cellulose solution is performed for instance by a rubber coated pair of rollers.

In some cases it is advisable after the treatment with the cellulose solution, to dry the textile material wholly or in part by exposure to the outer atmosphere or by means of hot air.

In every case the yarn is finally neutralised, washed and dried in known manner.

Examples

1. A cheese of cotton yarn or a mixed yarn of cotton and artificial fibres is impregnated by the creel system with a cuprammonium cellulose solution containing 3% cellulose and of a viscosity of a machine oil at ordinary tempertaure; the excess solution is pressed out with a compressed gaseous ammonia containing mixture f. i. air and gaseous ammonia which can easily be obtained by leading air through concentrated aqueous ammonia. Then the thread is treated with soda lye. For this purpose the thread may be unwound and guided through a warp smoothing machine and then, perhaps after further partial drying, the cellulose is regenerated on the fibres by diluted sulphuric acid of 6% H_2SO_4.

The threads which are treated with the cellulose solution and freed from the excess thereof, may at once be treated with diluted sulphuric acid of about 4% H_2SO_4.

2. A mixed yarn consisting half of cotton and half of fibres of cellulose acetate (or cellulose nitrate or ethyl cellulose or benzyl cellulose) is impregnated with a cuprammonium solution having a fluidity of a motor oil at 20° C i. e. between about 1,500 to 2,500 on the Saybolt scale and containing 2½% cellulose (calculated in air dry condition), freed from the excess solution and treated with one or more solutions adapted to precipitate the cellulose and/or decopper the precipitate. The material can be treated firstly with a dilute alkali lye, e. g. NOH of 5° Bé, and subsequently with sulphuric acid of 3% Bé, or it can be treated in one step merely with diluted sulphuric acid of slightly less strength say 2° Bé. After neutralisation and washing, the material is dried.

The yarn can be dyed with dye stuffs which go on cotton with difficulty and do not go on cellulose derivatives.

When the yarn is in hank or in bobbin form, all or but a part of the steps of the process can be performed in this form, while other steps, preferably the precipitating and/or decoppering step can be performed on the free thread f. i. during unwinding.

FRITZ DRECHSEL.

ALIEN PROPERTY CUSTODIAN

LIGHT REFLECTOR AND ALLOY FOR MAKING THE SAME

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No Drawing. Application filed August 30, 1939

This invention has for its object to provide a novel copper-aluminium alloy utilisable for making reflectors.

A further object of the invention is to provide a novel copper-aluminium alloy wherein the proportions of the alloying constituents are such as to render said alloy easily malleable, moldable or workable.

A still further object of the invention is to provide a reflector and particularly a light reflector made from said alloy and capable of reflecting pure orange-colored light rays or rays of long wave length, said reflector being mostly utilisable in photography or cinematography, for clinical work, for piercing fog and mist, for projecting anti-dazzling beams or for numerous other purposes.

With these and such other objects in view as will incidentally appear hereafter, the invention comprises the novel features or characteristics that will now be described and pointed out in the appended claims.

According to the invention, the novel alloy comprises, by weight, from 89.50% to 92.50% of substantially pure copper and from 10.50% to 7.50% of substantially pure aluminium. The proportions of the alloying constituents may vary within these limits but the most suitable or optimum proportions for obtaining an easily malleable and workable alloy capable, when shaped into the form of a reflector, to provide a surface that will reflect exclusively orange-colored rays are as follows:

	Per cent by weight
Copper	90.05
Aluminium	9.95

Advantageously the copper aloyed to the aluminium is refined copper or cupric copper as produced by electrolysis.

According to the invention moreover, the improved reflector is made entirely of the aforesaid copper-aluminium alloy, for example in the form of a solid plate or panel, or has its light reflecting surface or wall constituted exclusively by said alloy. When manufacturing the reflector, any alloy having the respective proportions by weight of copper and aluminium as above stated may be used with advantage. However, in order to obtain pure orange-colored light (as verified by spectral observation or analysis) an alloy containing 90.05% of copper and 9.95% aluminium should be used. If such proportions by weight are altered within the given scale, the results will be less perfect while being still satisfactory especially if the optimum proportions of the alloying constituents are approximated.

The property of reflecting light rays of long wave length and particularly orange-colored rays renders the improved reflector made of a copper-aluminium alloy as above described particularly valuable as a reflector in photography or cinematography (either for taking or for projecting moving pictures) also for surgical or clinical work and for the construction of motor car lamps or any other similar purposes because, as it is well known, orange-colored rays are non-dazzling and less detrimental to human eyes than white-colored light rays.

Furthermore, the property of rendering the reflected light rays capable of satisfactorily passing without diffraction through a heavy and dense mist or fog renders the improved reflector most valuable as a motor car lamp reflector or any other type of reflector as it facilitates traffic on roads in misty or foggy weather.

Moreover, this valuable property may be used with success in reflectors or projectors for the navy, anti-aircraft purposes, large mirrors for in industrial purposes, ship beacons, projectors for locomotives and railway traffic, aviation, landing grounds, air signalisation devices, light houses, photography and cinematography purposes, street and road signalisation devices, also for street or road lighting, home lighting, workshop and factory lighting, theater stages, open air theaters, artistic lighting for buildings, advertising signs, etc. Many other fields of application of the improved light reflector may be suggested, and this reflector can be produced according to any suitable shape and dimensions to suit any use whatsoever.

For producing the alloy of which the improved reflector can be made, pure copper in the selected quantity should be heated in a suitable receptacle to about 1160° C. to melt it. The receptacle containing the molten copper should then be withdrawn from the furnace and the copper allowed to cool to approximately 950° C. Aluminium in the form of small pieces, fragments, chips or scrap preliminarily heated to about 150° C. should then be added to the copper whereafter the two metals should be mixed to become alloyed. The alloy thus produced may be poured or cast into suitable ingot moulds, preferably made of earthen ware.

If the improved reflector is used for example for surgical work, in photography or cinematography, in a motor car lamp or any other similar

purposes, its reflecting surface should be perfectly smooth and polished, the outline of said reflector being of suitable shape, for instance of a parabolic shape for imparting perfect parallelism to a beam of light rays emanating from an electric bulb or other source of light located at the focus. The transparent panel fitted in the hinged door of the casing of a lamp for motor cars should be made advantageously of a colorless glass. The rim in which such a glass panel is fitted may be made of the same alloy as the reflector. If such is not the case, the said rim should be so located outside the periphery of the reflector as to have no influence on the beam of reflected light rays.

For use in photography or cinematography or for clinical work, for the construction of motor car lamps or any other similar purposes, the source of light of suitable power located at the focus of the reflector made of the copper-aluminium alloy as above-stated may be provided advantageously with a forwardly located screen or shield of the same metal as the reflector capable of throwing back the rays emitted by the said source of light towards the wall of the reflector. Such a screen or shield may be constituted for instance by a coating applied to the front portion of the glass wall of an electric bulb of the usual type, if such a source of light is used.

No constructional obstacle must be left inside the lamp that would interfere with the proper path of the light rays reflected by the improved reflector.

WILHELMUS HERMSEN.
FRANCIS JOSEPH DELVES.

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ALIEN PROPERTY CUSTODIAN

PROCESSES FOR THE PRODUCTION OF ASBESTOS CEMENT SLATE POSSESSING INCREASED BENDING AND IMPACT STRENGTH

János Albert, Budapest, Hungary; vested in the Alien Property Custodian

No Drawing. Application filed August 30, 1939

Artificial slate produced on paper-machines from cement mortar mixed with asbestos fibres, presents a relatively low bending and impact strength. While this is less important in the case of smaller slabs as employed for roof covering, it is a serious drawback in the case of large slabs as employed for lining purposes or as constructional elements.

The low mechanical strength of artificial slate is due to the high density of its substance, while artificial slate of lower density could not be obtained as other artificial stones by high dilution of the mortar used for its production because the density of the mortar taken up by the sieve drum of the paper-machine is practically independent of the dilution of the mortar into which the sieve drum is dipped so that the density of the product will remain invariably between 2 and 2.2.

According to the invention this drawback can be eliminated by adding to the mortar prepared with cement and asbestos fibre and used for the manufacture of the slate, diatomaceous earth amounting to between 10 and 20 per cent of the weight of the cement and saponifiable organic acids such as fatty, resinic, or naphthenic acids, amounting to between 15 and 30 per cent of the weight of the cement, emulsified with a quantity of alkali approximately sufficient for the saponification of the acid, and diluting the mortar with water, such as 10–20 times the weight of the cement, to a consistence suitable for working in a paper pulp engine.

Advantageously 20 to 30 per cent of the total quantity of cement may be substituted by trass, and preferably 10 to 20 per cent filling substance may be added consisting of stone garble, ground to pass a sieve with 64 meshes per square centimetre.

The layer taken up from the above said mortar by the sieve drum of the paper machine contains and keeps up to its solidification so much water that the weight per cubic decimetre of the dry slabs will be less than 0.6 down to 0.1 kilogram.

Though the quantity of soap incorporated with the mortar is a multiple of the quantity which has been considered as dangerous for the mechanical strength, it has been found that the mechanical strength will not be inadmissibly lowered. Although the specific bending strength of the material of these slabs will be lower than that of compact artificial slate, the thickness of a plate produced according to the invention exceeds the thickness of a compact slab having the same weight per surface unit to such a degree that owing to the increased modulus of inertia of the higher cross-section, the new slab will carry a substantially higher bending load than a compact slab of the same weight per surface unit. The impact strength of the slab according to the invention is substantially higher than that of compact slabs.

Example

To a mixture composed of 80 parts by weight of Portland cement, 10 parts by weight of diatomaceous earth, 15 parts by weight of stone garble passing through a sieve of 64 meshes per sq. cms., 20 parts by weight of trass and 18 parts by weight of asbestos, an emulsion is added composed of 20 parts by weight of resin emulsified in 30 parts by weight of water with 2 parts by weight of sodium hydroxide. This mortar is diluted in a paper pulp engine with 1000 parts by weight of water. The diluted mixture is worked on a usual machine for production of artificial slate substantially similar to a paper-board machine. The flattened layers of mortar removed from the drum of the machine are, however, not squeezed between plates, as usual in the manufacture of compact slabs, but are allowed to harden in the loose condition in which the mortar mix settles on the paper-machine drum. After drying, the weight per square metre of the slabs of 10 mm thickness is not higher than 9 kgs.

The rinsing water leaving the sieve drum contains the finer particles of the mortar not retained by the sieve. The mortar being diluted by the rinsing water up to five times its original volume, part of the cement settles and is utilised for the next mortar batch, while the remaining portion of the mortar particles is carried upwards by the floating soap. According to the invention this latter, upper portion of the rinsing water in which the soap and cement waste concentrates, is added too to the next mortar batch.

JÁNOS ALBERT.

is practically independent of the velocity and the air-resistance is about proportional to the square thereof, so that the couple of forces necessary to drive with uniform speed on a horizontal or slightly sloping road, is to be considered as constant+a value, increasing with the square of the speed c. q. of the secondary number of revolutions. As standard for this value according to the invention efficient use can be made of centrifugal-action or oil-pressure, for instance derived from the action of a gear pump, which indeed are proportional to the square of the number of revolutions, whereas for the constant to be added thereto, for instance a constant (if desired, adjustable in accordance with the car-load) spring-tension comes into consideration, giving an initial tension to the system. The centrifugal-action or oil-pressure, which is a standard for the primary or secondary number of revolutions and the obtained couple of forces can be derived, resp. measured from the driving as well as from the driven or another shaft. Instead of the centrifugal action or oil-pressure also another, for instance an electric force-action can be used as standard for the primary or secondary number of revolutions.

A simple embodiment of a part of the invention is obtained by dimensioning in a construction according to the figures 21 and 22 or 24 and 25 of the just mentioned patent resp. according to figure 1 of the Dutch patent specification 83 399 (U.S.219 087) the spring **47**, resp. **19** in such a manner and by giving them such a bias that their action together with the centrifugal-action of the balls **40**, resp. **10** and with the axial force excited by the primary couple owing to the converging adjustment of the surfaces **63**, resp. **65** resp. **12** produces a suitable dependence between the secondary number of revolutions, the primary couple and the gear-ratio. It goes without saying that the choice of the profile shapes and of the mutual position of the surfaces, with which the balls cooperate, influences the just mentioned dependence.

The embodiment of the invention in a construction according to the figures 21 and 22 of the Dutch patent 33 517 has the drawback that the balls **40** exert a considerable sliding and/or rolling friction on the surfaces **63**.

This drawback is much reduced by constructing these surfaces corresponding to that patent as rotatable cylinder mantles **65** in the figures 24 and 25 resp. according to the patent application 83 399 as cone-mantles **12** and **12***a* in the figures 1, 2, 5 and 6.

Yet the balls, also on these mantle-surfaces, still exert a spinning friction, because the point of intersection of the axes of rotation of a ball and the mantle surface, with which it cooperates lies rather far from their mutual point of contact.

This objection is avoided in the construction according to figure 1 of this application.

The inertia action and friction-resistances, prejudicial to a smooth and yet stable regulation, which in the device indicated in this figure oppose to the adjustment of the gear ratio may be reduced according to the invention, by constructing the device in such a manner that instead of the action of a separate centrifugal-governor, just as in the above-discussed application of the invention in a construction according to the Dutch patent 33 517 the centrifugal action of the round intermediate bodies, (planets), transmitting the power from the primary race to the secundary shaft, is used as an indication of the secundary number of revolutions.

By means of the description of the figures embodiments according to the invention and valuable particulars will be further elucidated. For a good understanding of these embodiments the above mentioned Dutch patent specification 33 517 and the Dutch patent application 83 399 (U.S.A.219 087) are also referred to.

Figure 1 is a partial (upper part) cross-section of a construction according to the invention;

Figure 2 is a view from the left in figure 1 against the secundary *g* head (**142**), that is to say the body or assembly connected with the secundary shaft (normally the driven shaft) with which the planets cooperate;

Figure 3 is a view, according to the arrow *q* in figure 1, of a planet (ball) with the associated clamping body;

Figures 4–7 elucidate the constructions of a screw-bearing;

Figure 8 represents the construction applied in figure 1 for compensation of the centrifugal-force acting on the planets;

Figure 9 shows another embodiment of a planet with some of the surfaces cooperating therewith;

Figure 10 is a partial cross-section of another embodiment.

Figure 11 shows how a planet in figure 10 cooperates with two clamping surfaces, seen according to the arrow *p*;

Figures 12 and 13 are other embodiments of a planet with some of the surfaces cooperating therewith;

In figure 1 each ball (planet) **134** cooperates with a reaction member **135**, carrying a brake drum **136**, further with a primary surface **137**, which by means of the key **137***a* is connected with the driving (primary) shaft **145** and with a secundary surface **138**.

With the brake drum cooperates a brake or coupling, by means of which the house and the reaction-member **135** in the positions with reduced gear ratio is braked or blocked. At the gear ratio 1:1 and during stationary running of the motor coupled with the flange **145***a*, the brake releases the reaction race **135** and the latter can rotate with the planets, resp. opposite to the direction of rotation of the motor.

Automatically operating constructions of brakes and couplings for this purpose have been described in the Dutch patent application 83 399.

The secundary surface, with which each ball cooperates, has been constructed as a cup **138** rotatable about the axis *a—a*. The cup bears on a pressure bearing **139** and the shaft **141**, which has been secured to the cup, is supported in a ball-bearing **140**. The assembly of cup and bearings has been mounted on a resilient part **142** of a cup-carrier **144**.

Figure 2 shows, how, separated by saw-cuts **143**, a number of parts **142** have been formed which depend freely from the periphery of the carrier **144**. The resilient support of the cups attends to such a self-adjustability of the cups that the load is evenly distributed over the planets.

Figure 3 shows a view on the ball **135**, drawn in the figure 1 with the associated cup **138** (according to the arrow *q* in figure 1). From this it appears that the axis of the cup is at an angle with the line indicated by *x—x* in figure 1. The axis of rotation *a—a* of the cup thus crosses the shaft of the device *x—x*. It intersects however the

axis $y—y$ of the ball 134 in the point S (figure 3). The shape of the concave cup-surface 138 and of the screw-surfaces of 156 and 157, between which there are three balls 158, which members also determine the equilibrium of the part 144, have been chosen in such a manner that the tangent surface A—A in the point of contact (properly speaking a small surface of contact, which has been indicated in the figure by the points R and Q) passes through the point S. This means that the ball in RQ cooperates with the cup in an analogue manner as two conical toothed wheels ($RR':QQ'=RR'':QQ''$, in which RR', etc. represents lines perpendicular to the axes $y—y$ resp. $a—a$) in other words that the small surfaces RQ can roll over each other without slip and without spinning friction. When now care be taken that when varying the gear-ratio, that is to say when shifting the points L and K (figure 1) the pressures of the surfaces on each other are always large enough and that the above-mentioned proportional equation is complied with, neither slip nor spinning friction can ever occur between ball and cup.

This is very well possible according to the invention, namely by taking care that when varying the gear ratio the balls are shifted together with the cups with respect to the primary surface 137, whereby then also the reaction member 135 undergoes an axial displacement. This takes place amongst others by means of the screw-bearing 156, 157, 158, 159. As shown by figures 4–7 the three balls 158 of this bearing run in sloping paths of the races 156 and 157.

For compensation of mutual differences of the races of the three balls and/or of a slight deviation from the co-axiality of the parts 156 and 157, (also) under influence of an unsymmetric load of the part 157 if any, the ring 159 adjusts itself somewhat excentrically so that the balls begin to run on different radii. Due to this a (slight) difference may occur in their rotating movement. This difference is not always eliminated when returning so that one of the balls return somewhat earlier than both the others into the deepest point of its path, hence passes this deepest point before the other balls reach their lowest point. When going to and fro for a long time this difference sometimes becomes larger and larger, so that finally undesired jamming occurs and the equal distribution of forces over the three balls aimed at is not at all obtained. The deviation may even become so large that one of the balls becomes totally unloaded and rolls to the deepest point of its range in the part 157. If this happens when the part 156 is at a considerable angle from its lowest position thus a large deviation occurs in the angles between the radii to the balls due to which the uniformity of the screw in movement aimed at, is disturbed.

To avoid this drawback the ring 159 has been provided with three small convex-shaped cavities (for instance in small pieces of thin copper 171 at 170 (Figure 6) having radii of curvature which are somewhat larger than those of the balls 158, so that these near their poles (of the rotation) lie in the small cavities and rotate herein during the screwing movement. Thus the angles between the radii to the balls can no more get a large deviation of 120°, whereas the light rolling motion remains safeguarded because the contact-pressure against the small cavities need only be small.

It be stated here that these balls 158 and the sloping races can be replaced by unround, for instance approximately elliptic bodies 167 (Figure 7), which can run into grooves 168 and 169 and push off thereon.

For experimenting purposes this construction has the advantage that then the shape of the unround bodies can more easily be modified, than the shape of the sloping surfaces 156 and 157 which is much more expensive and time-consuming.

The reaction-member 135 (Figure 1) is connected at 137b with a disc 138a, which is rotatable about the member 162 by means of a conical roller-bearing 161–160. Further the reaction member is supported on a ball-bearing 172, which is shiftable over the primary shaft 145. The centrifugal weights 163 are, by means of joint surfaces 173, supported on the member 165 keyed to the secondary shaft 153 and by means of joint surfaces 174 they are supported in a recess 175 of the member 162. The recess 175 forms one side of a recess in the member 162 which recess has a square section.

Against the centrifugal weights 163 press the edges 176 of rubber blocks 164 which on the other side are supported with their edge (a shield frame) 177 on the member 165.

The rubber blocks press the centrifugal weights 163 (in this embodiment one should think of four blocks) outwards in a biassed manner. In operation this force-action is increased by the centrifugal forces on the parts 163. Corresponding axial-forces are exerted on the parts 165 and 162 by the lever arms 173 and 176.

The part 146 of the primary surface bears against a ball bearing 147. In the space between the secondary shaft 153 and the primary shaft 145 still a radial ball bearing 151, an axial pressure bearing 149 and distance pieces 148—140, as well as a locking nut 152 are mounted.

In Figure 1 is to be seen that the axial force actions are taken up in the circuits 134, 138, 139, 142, 144, 155, 156, 157, 160, 162, 163, 165, 153, 152, 151, 150, 149, 148, 147, 146, 137, 134 and 134, 138, 139, 142, 144, 155, 156, 158, 157, 160, 161, 135a, 135, 135b, 134.

In the construction according to Figure 1 the influence of the centrifugal forces acting on the balls 134 can be compensated as follows.

With the cup carrier 144 a member 154 is connected having fingers 175 (Figures 1 and 8), which seize between the balls 134. Pressure members 179 are flung outwards by the centrifugal force (vide force C, Figure 8). They are guarded from falling inwards because by means of a spring 179b they are connected to the body 154. The pieces 179 press at the one side against the finger 178 and at the other side with a cup-shaped part 179 against the ball 134. The component C_t of the centrifugal force acting on the pressure pieces 179 drives the balls in their clamping space against the action of the centrifugal force acting on the balls. When the motor is braked, hence when the secondary shaft starts a driving action the balls 134 are pushed in the direction of the arrow g in another clamping space (compare the cups 138). Then the pressure pieces 179 slip below and past the finger 178 in the dotted position according to Figure 8 (the spring 179b too has been drawn in dotted lines) and press the balls 134 against the centrifugal force acting thereon in the clamping space appertaining to the situation in which the secondary shaft exerts a driving action.

In the construction according to Figure 9 the balls 134 are always pressed into the same clamp-

ing spaces by means of either or not self-adjusting counter rollers 180. Further means to compensate the centrifugal forces on the balls are not necessary here. Each small roller 180 has been mounted on a spindle 181, which has been secured in a resilient part 142 of the cup carrier 144.

When the secondary shaft acts in a driving manner the couple of forces can be transmitted to the balls 134 and further to the primary shaft by means of the counter rollers 180.

Here the centrifugal forces on the balls are not compensated in a literal sense by a force excited in a direction opposite to that C-force.

Now just this circumstance can be used according to the invention to obtain the desired influence of the number of revolutions on the couple to be transmitted, without separate centrifugal weights being necessary for this.

In the construction according to Figure 10 the centrifugal weight-governor 163 according to Figure 1 has been omitted which still offers the advantage that detrimental inertia- and friction-actions, if any, which, when braking with the motor might cause an alternating action with the inertia-action of the auto, cannot occur either.

In the construction according to Figure 10 twelve balls 200 cooperate with a race 201 of a body 202, with a race 203 in the house 204, 205. Further each ball 200 cooperates with two rotatable cones 206 and 207 (see also Figure 11) the shafts of which intersect the main-axis x—x of the construction and which bear in such a manner in the carrier 219 that between each two of the balls 200 there is a cone 206. The body 202 is provided with a race 208, which is part of a toroidal-surface and cooperates with three balls 209, which are at mutually equal distances in three uniformly shaped grooves 210 of a body 211 which has been secured to the driving shaft 250 by means of cannelures 213.

The balls 209 with the grooves 210 and the race 208 constitute a screw-bearing which turning to the right (seen from the left hand side according to the axis x—x) exerts an axial force on the part 202, which is directed to the right in the figure.

The balls 209 are gripped in a cage 212. In the holes of the cage 212 small cups may be arranged the shape of which is so determined with respect to the balls 209 that between the ball-surface and the cup a good oil-film-lubrication is obtained.

Between the cage 212 and the body 211 a flexible spring is mounted, which acts parallel to the screwbearing 209—210, because it exerts such a couple of forces on the cage 212 that the ball 209 represented in the figure is pressed backwards as far as the represented position, in which the contact points of the planets 200 and the part 202 nearly lie on the axes of rotation of the planets. These are the diameters, which pass the point of intersection of the axes of the conuses 206 with main axis x—x (direct drive position).

The house comprises two parts 204—205 connected with screw-threads and a resilient front-plate 216, which has some initial tension and tries to press the body 203 in the figure to the right, that is to say, in a position with reduced gear-ratio.

The house is supported on two ball-bearings 217 and 218 and can rotate about the main-axis x—x.

Round the house a maximum brake or maximum coupling is arranged by means of which the house in the positions with reduced gear ratio of the transmission is braked or is coupled with a stationary body, for instance the frame of an autocar. At the gear ratio 1:1 (direct drive) and at stationary running of the motor coupled with the shaft 250 the brake releases the house and this can rotate with the planets.

Automatically operating constructions of brakes and couplings for this purpose have been described in the Dutch patent application 83,399. The cones 206, situated each at both sides of a planet 200 are rotatably supported on a somewhat resilient disc 219. This disc may again be provided with saw-cuts (vide Figure 1) so that radially resilient parts are formed, which make an equal distribution of the load over all planets possible.

Between the secondary (driven) shaft 215 and the body 219 there is again a screw-bearing 220—223 for instance as described before with reference to Figures 4–7. Further an axial pressure bearing 230 is mounted between the primary and secondary shaft between 250 and 215).

The screw-bearing comprises three balls 220, races 221 and 222 and cage 223. This screw-bearing as well as that according to the Figures 4–6 has surfaces constituting parts of helicoidal surfaces with right and left pitch. The pitch angles, dependence of the requirements of regulation the apparatus should satisfy are chosen in such a manner that when the shaft 250 is driven by the motor according to the arrow P, the body 219 screws in the figure to the left so that also the body 202 is moved to the left in the figure under influence of the forces exerted thereon by the balls 200. During this operation the cage 212 is adjusted with respect to the part 211 against the action of the spring-force 214 by means of the balls 209 according to the arrow P.

The planets 200 are pressed to the left and towards the axis x—x into a position in which the gear ratio is smaller than 1:1.

Due to the screwing actions of the grooves 210 and the screw bearing 221, 220, 222 the planets 200 are clamped between the surfaces 201, 203 and 206 in such a manner that they cannot slip with respect to any of these surfaces.

The centrifugal force on the planets 200 has the tendency to move the planets outwards and in the figure to the right, thus to bring the device into the direct drive position against the force-action just considered.

The shape and the position of the surfaces 201, 203, 206, 210, 221 and 222 the number and the size of the balls and the characteristics of the spring 214 and of the resilient plate 213 can be chosen in such a manner that the device, as well when the power of the motor is positive as when it is negative, automatically adjusts itself in all circumstances to an efficacious gear ratio.

The initial tension of the plate 216 has the purpose to displace the house 204, 205 somewhat to the right when the balls 200 do not exert on the surface 203 forces, the axial components of which surpass said initial tension. Because of that when the secondary shaft is at rest, so that no centrifugal forces act on the balls, a position with a small gear ratio will be obtained so that the motor can rotate stationary without having to exert the couple, which otherwise would be necessary to bring the device out of the direct drive position. This is of importance for the stationary rotation of the motor.

Instead of the cups 138 (Figures 1 and 9) or of

the cones **206** with their supports also a construction according to (Figure 12) can be used.

Here the ball **134**, by means of a ring **195** and the small balls **194**, bears against a spherical cup **196**, which cannot rotate about its axis and is connected to the part **142**, resp. **210**. The center of curvature of said cup is a point T, which is situated in such a manner with respect to the center M of the ball **134** that the latter can move just as in the above described constructions, somewhat towards or from the main-axis $x—x$. The small balls **194** can also cooperate directly with the ball **134** c. q. with a groove ground in the ball **134** instead of with the ring **195**.

Figure 13 illustrates that the planet bodies need not always be balls. Here each planet body **193** cooperates by means of small balls with a cup **199** connected with the secondary head **198**.

Obviously the application of the invention is not limited to the described embodiments. It can also be used entirely or partially for other purposes, for instance in aircraft, in electro-motors, machines for tooling purposes, lifting machines, etc.

CORNELIS ANDRIES HEERO MULDER.

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C. A. H. MULDER

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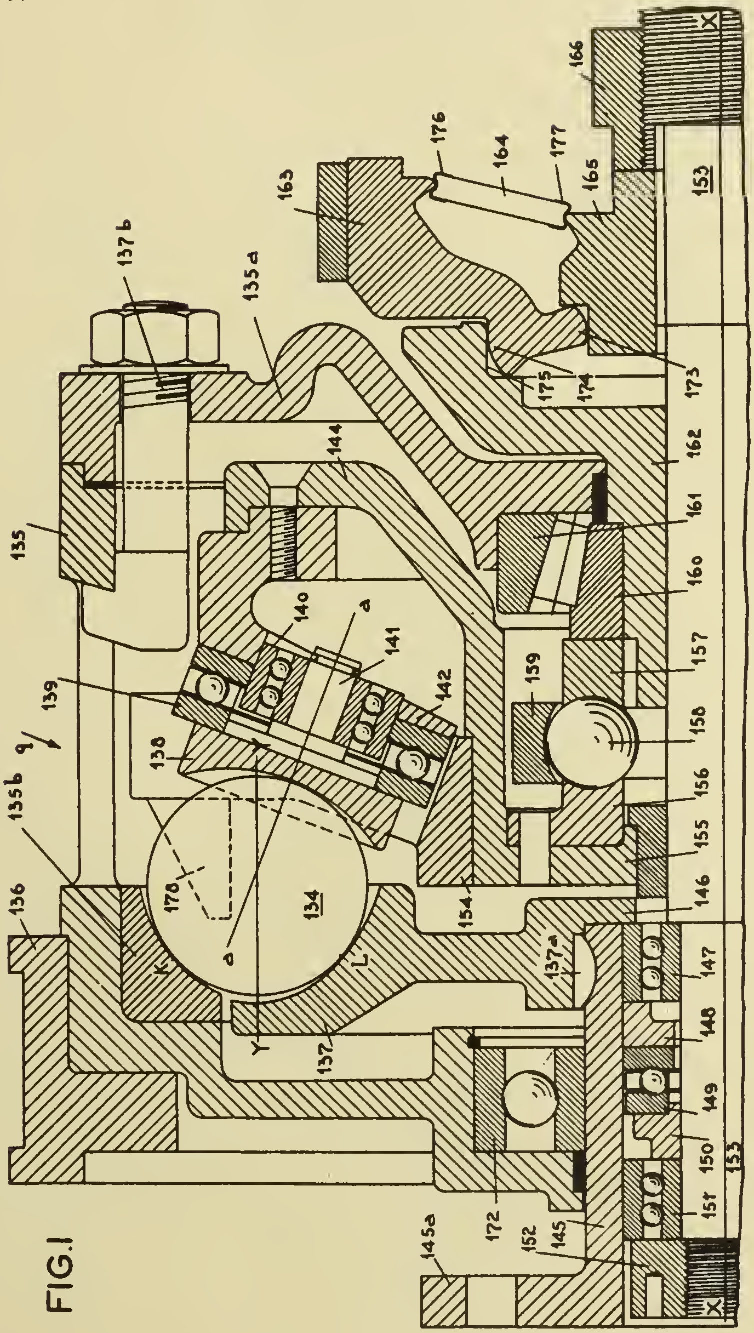

FIG.1

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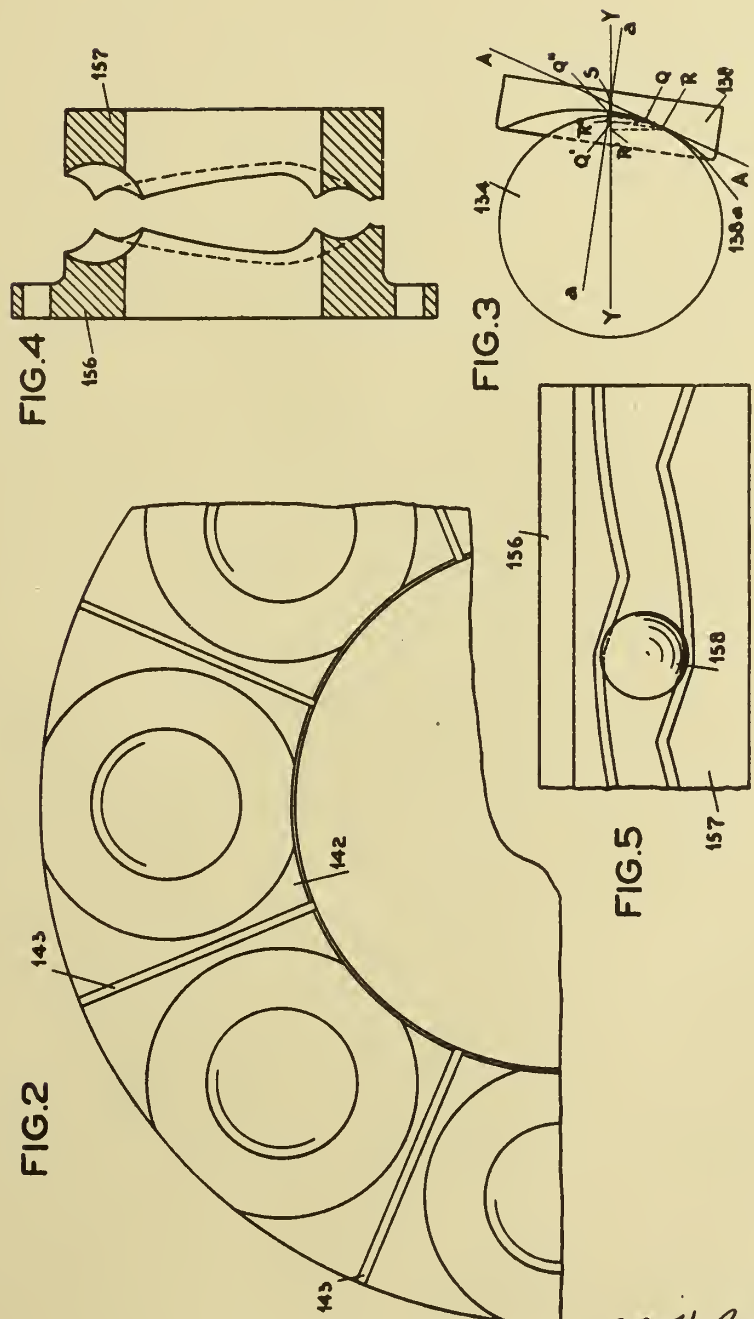

FIG.4

FIG.3

FIG.2

FIG.5

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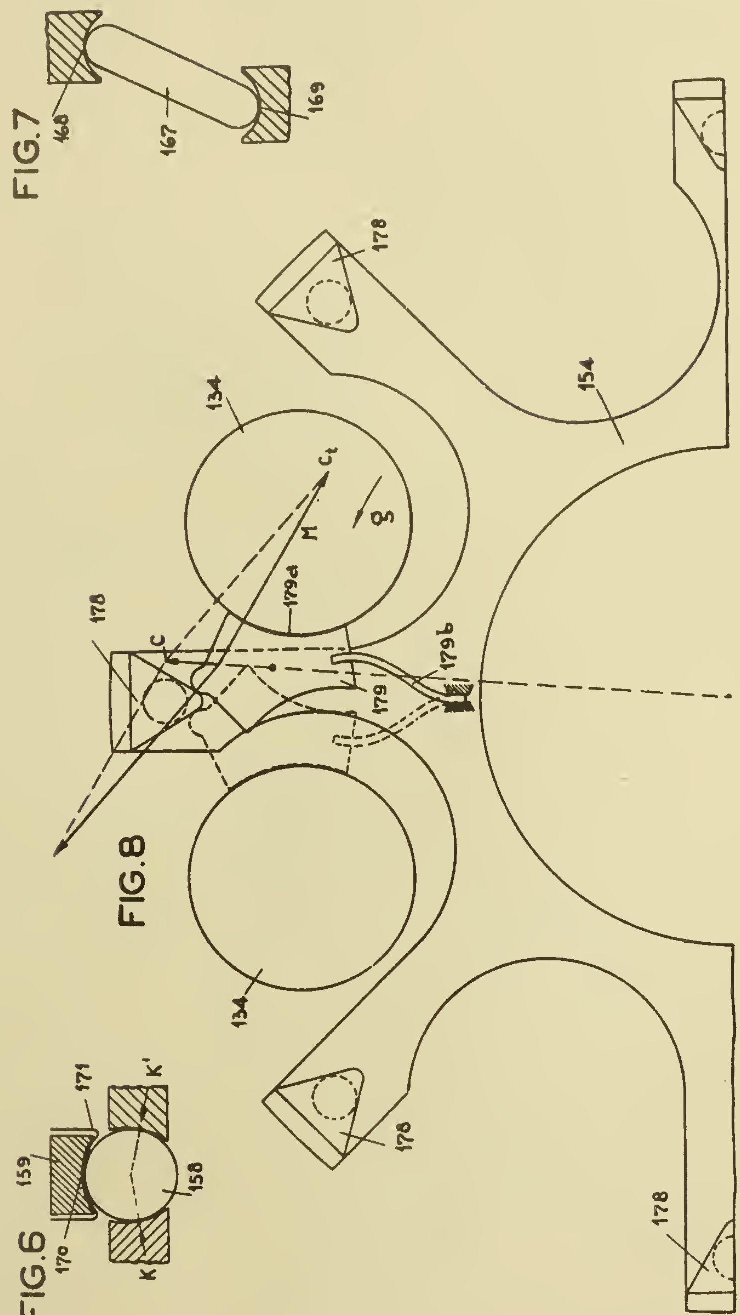

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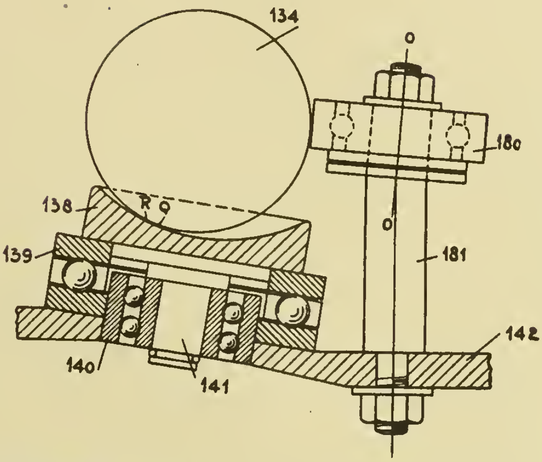
FIG.9



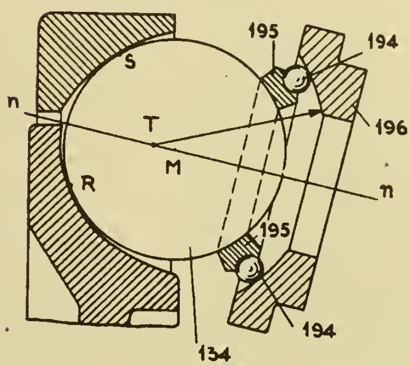
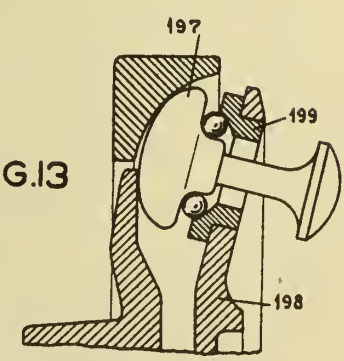


FIG.12

FIG.13



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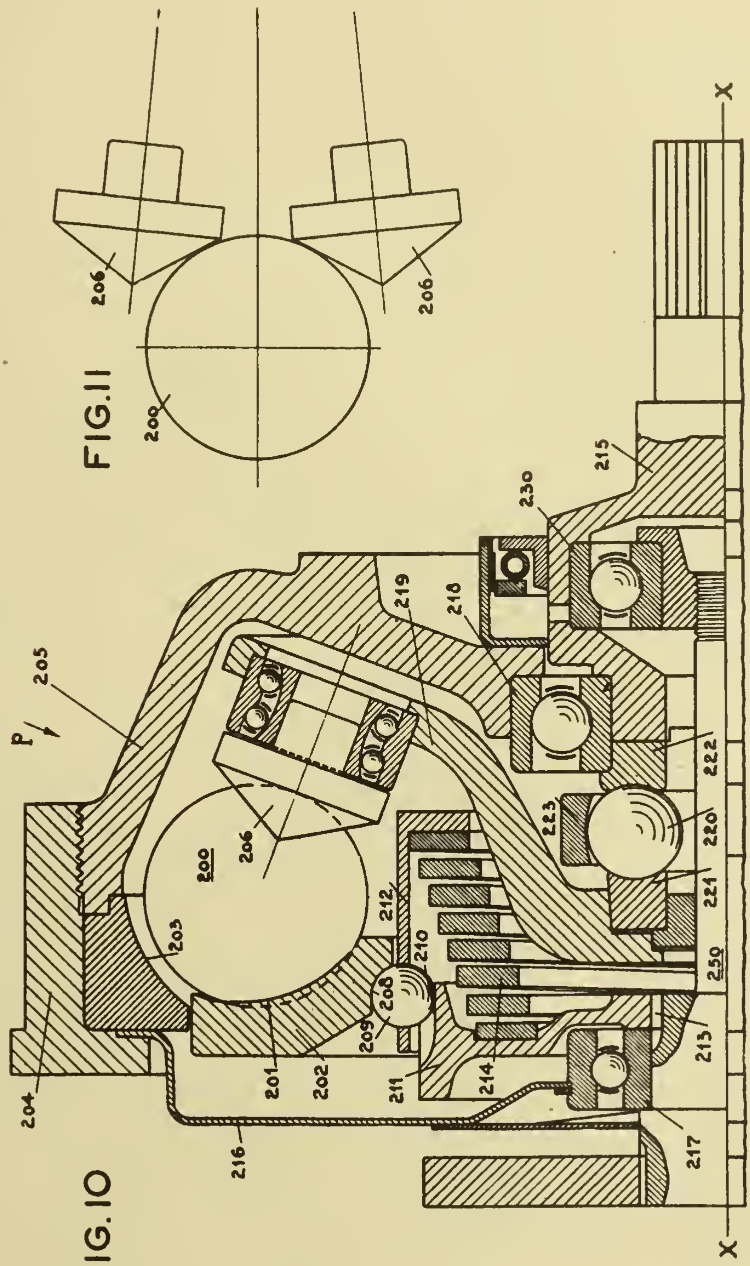

FIG.11

FIG.10

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ALIEN PROPERTY CUSTODIAN

ARMOUR-PIERCING PROJECTILES

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Application filed September 15, 1939

Projectiles for piercing or tearing armour plates, whether they be armour-piercing projectiles, semi-armour-piercing projectiles, or high-explosive armour-piercing projectiles, have hitherto generally been made of steel alloys of which the constituents determining the properties of the alloy are carbon, chromium and nickel. A carbon content up to 1.75 per cent., preferably 1.1 per cent., and a chromium content up to 2.5 per cent. were regarded as required to produce hardness. It was believed to be necessary to add nickel in the same amount as the chromium or even in greater amount in order to lessen the brittleness exhibited by steels hardened by the aforesaid quantities of carbon and chromium.

It has also been proposed to produce a projectile having a hard skin and a soft core by subjecting to a special heat treatment an alloy containing 3.5 per cent. of chromium and 6 per cent. of carbon. For armour plates the alloy could contain a smaller quantity of carbon, the parts of the plates which required the greatest hardness, especially the surface, being subsequently carbonised by cementation.

This method would be impracticable for the production of projectiles, especially small projectiles having a calibre of the order of magnitude of 4 cm.

The present invention consists in armour-piercing projectiles made of a steel alloy the composition of which with respect to the main constituents named above differs substantially in two respects from the known alloys, but which shows a surprising improvement with respect to the performance and the piercing force of the projectile. The projectiles of the invention are made of a chrome steel free from nickel and containing 2 to 3.5 per cent. of carbon, 2.5–5 per cent. of chromium and up to 1 per cent. of manganese and silicon. This steel is especially advantageous for the production of high-grade armour-piercing projectiles of the smaller calibres; it affords a good hardness reaching to the core, shows during hardening remarkably little tendency to form cracks and has an outstanding piercing force owing to the great hardness which it can attain, which is of the order of about 630 Brinell units.

It is to be understood that the expression "free from nickel" includes the case in which the alloy contains traces of nickel which cannot be removed by ordinary industrial processes. The quantity of carbon preferably does not exceed 2.5 per cent. In certain cases the chrome steel may contain one or more of the metals molybdenum, vanadium, titanium, tantalum or beryllium, depending on the properties required of the alloy, the quantity of such metal or metals not exceeding 1 per cent. The contents of manganese and that of silicon are not of decisive importance provided they are kept within moderate limits, preferably, for example, about 0.4 per cent. or less.

When 2 cm. armour-piercing grenades made of a steel containing:

	Per cent
Carbon, about	2
Chromium, about	3.5
Silicon, about	0.35
Manganese, about	0.40

were shot at an angle of incidence of 90° and ranges of 200 and 600 metres at armour-plate of the latest kind having a thickness of 30 mm. and a material strength of 170 kgm^2, the plates were pierecd, while hardened projectiles of the kind hitherto known, even with a relatively high chromium content, for instance 12 per cent., were shattered by the plates without piercing them.

As is known in the manufacture of projectiles, only the head of the projectile which is subject to the greatest stress on impact with the target need be made of the nickel-free alloy according to the invention, the head being welded on the body and base of the projectile, which may be made of carbon steel or an alloy steel. We have found that the steel alloy according to the invention can readily be welded on to other steels which, in spite of a lack, or only a small quantity, of high-grade alloying metals are adequate for the less stressed part of the projectile. In this manner there are obtained projectiles with a tenacity of the whole projectile and a hardness of the head which are as effective in piercing armour-plate targets as projectiles made throughout of the alloy according to the invention.

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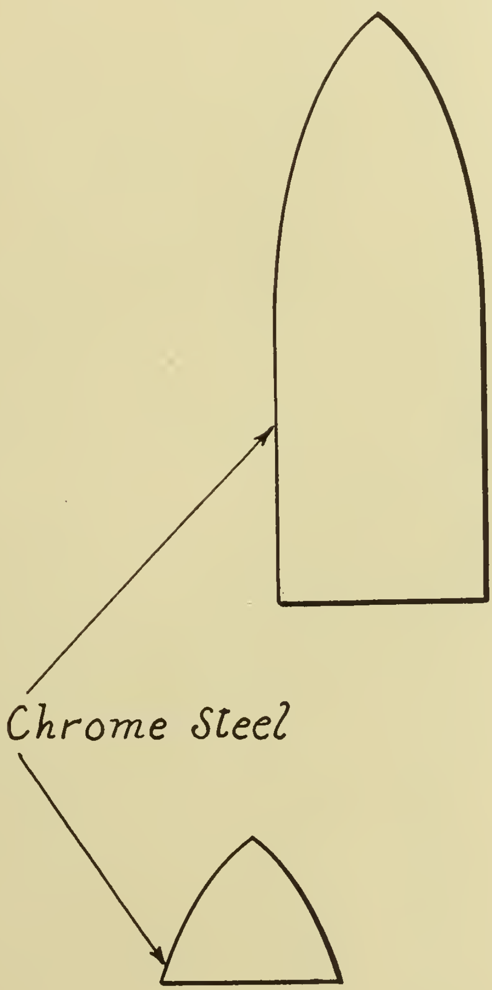

Fig.1.

Fig.2.

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ALIEN PROPERTY CUSTODIAN

POWER TRANSMITTING MECHANISM FOR MOTOR VEHICLES

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Application filed September 16, 1939

This invention relates to the transmission of power through a variable speed gear transmission between an internal combustion engine and the wheels of a motor vehicle. It is particularly concerned with the transmission of power in large and heavy vehicles such as rail cars, and is directed to a combination mechanism of practical size and adequate transmitting capacity which enables power from the vehicle engine to be transmitted without strain or jerks, and which enables shifting to different gear selections with facility and without strain on the operating parts.

Variable speed transmissions which are shifted manually are not suitable for large and heavy motor vehicles because of the considerable shifting force required and inability to judge the relative speed of the gear parts to be engaged and determine the proper time to complete engagement. Also, especially in rail cars, power operated gear shift transmissions adequate to transmit the high power involved in such cases are either too large, or if made sufficiently compact to be employed in the small space available are inadequate for the power of the internal combustion engine employed. A prolonged period is required for shifting from one gear selection to another, and the change in speed of the vehicle is relatively abrupt and manifested by undesirable jerks.

It has heretofore been attempted to overcome these difficulties through electrical power transmitting mechanism between the vehicle engine and wheels so that the torque of the engine might be transmitted and varied in a smooth and uniform manner. Such arrangement, however, has the disadvantage of high cost, great weight, and large space requirement per unit of output power. It has now been proposed to overcome the problem by effecting a drive from the vehicle engine to a variable speed gearing through a hydraulic torque converter.

In the latter combination the variable speed gearings heretofore employed in association with the hydraulic torque converter have been difficult to shift, and could be shifted only with prolonged interruption in the transmission of power from the engine to the vehicle wheels. Friction clutches if employed had to be too large in dimension. Synchronizing mechanism where employed permitted chattering and jars in the transmission parts during shifting. The wear on the parts was extremely heavy.

The mechanism of the present invention is designed to overcome the objections just referred to by providing a combination hydraulic torque converter and variable speed gearing giving a minimum of noise while running, permitting satisfactory shifting of the gears, and giving minimum wear and necessitating minimum size. The arrangement is such as to give a wide speed range for a relatively small number of gear selections.

According to the invention power is transmitted from the vehicle engine through a hydraulic torque converter to a variable speed gearing having constantly meshing gear pairs wherein jaw clutches are provided to effect a shift from one gear selection to another. Such clutches are so designed that upon being brought towards engagement they will come into positive engagement as the parts to be connected attain substantially the same speeds. The shafts of the gear trains are preferably divided into a plurality of sections.

Where it is desired to provide intermediate speed ratios and employ only a relatively small number of stages in the variable speed gearing, as for example, for towing, and to provide a speed ratio lower than the lowest ratio of the gear transmission, the invention contemplates the provision of a planetary gearing between the fluid coupling and the variable speed gearing.

Fig. 1 is a sectional elevation of a power transmitting mechanism according to the invention; and,

Fig. 2 is a similar view of a modified construction incorporating a device not shown in Fig. 1.

In Fig. 1, 1 is the vehicle driving motor for example, an internal combustion engine. The driving part 4 of a fluid coupling, or hydraulic torque converter, is driven through the gears 2 and 3. 5 is the stationary axle of the directing vanes. 6 is the driven part of the torque converter. 7 is an axial bore which serves to supply operating fluid to the torque converter while the axial bore 8 supplies pressure fluid to the pressure chamber 10 of a friction clutch whose halves 12 and 13 are connected together by means of discs 15 which are pressed together by the pistons 14. The main shaft 20 which is broken at a number of places is located in the transmission housing 16 which likewise contains the broken counter shaft train 21. The constantly meshing three gear pairs 22 and 23, 24 and 25, 26 and 27, are shifted alternately by the overtaking jaw clutches 28—31 having teeth with inclined front faces.

The construction of Fig. 2 includes in addi-

tion to the mechanism of Fig. 1 a planetary gearing located in the front end of housing 16 and forming a driving connection between the torque converter and the gear transmission. In Fig. 2, 33 is a planet spider which is connected to the main shaft 20. 34 is an internal gear and 36 a sun gear; between the two there are meshed the planet gears 35. The discs 15 are arranged rotatively or movably on the one hand on the planet spider and on the other hand on the coupling element 41. Pistons 40 are mounted in pressure chambers 42. The line 44 opens into a stationary hollow ring 45 which surrounds the shaft 50 connected to the shaft of the torque converter. The bores 46 also open into this hollow space. 47 and 48 are further hollow spaces for the pressure fluid.

In shifting the friction clutch 12 and 15 is disengaged and the necessary shifts are rapidly effected in the transmission with overtaking jaw clutches in the manner usual with such transmissions.

In order to start in the lowest gear the jaw clutches 29 and 30 are brought into engaging position as shown in the drawings. The hydraulic torque converter is already filled with operating fluid through the channel 7. The pistons 14 under the action of pressure fluid from the bore 8 in the pressure chambers 10 compress the discs 15 together thus engaging the clutch. Since the vehicle is to start from a full stop the torque converter gives a great torque to the driven part corresponding to the R. P. M. of the driving motor and the large value of the ratio between R. P. M. of the driving and the driven portions of the converter. The low ratio corresponding to low gear in the transmission still further increases this torque. Under ordinary circumstances this suffices to overcome any resistance which is practically encountered in operation.

The planetary gear in the embodiment of Fig. 2 is for the purpose, when necessary, of providing still further intermediate gear ratios and particularly one lower than low gear with a corresponding range determined by the torque converter. If for example the planetary gear is to be engaged in low gear the pressure of the pressure liquid on the pistons 40 through the line 44 the hollow ring 45 and the bores 46, 47 and 48 is relieved resulting in a disengagement of the discs 39 on the other hand the band brake 32 locks the sun gear 36. As a result the internal gear 34 driven from the hydraulic torque converter rotates and the planet spider 33 transmits to the main shaft 20 of the transmission a further increased torque resulting from the double rotation of the planet gears 35 on the internal gear 34 and the sun gear 36.

If the next higher gear is to be engaged, in this case low gear, the gear reduction of the planetary gear is thrown out by releasing the brake 32 and introducing oil under pressure through the line 44. This reaches the hollow ring 45 and the chambers 47 and 48 and bores 42 and presses the pistons against the discs 39. As a result the planet spider 33, the internal gear 34 and the jaw clutch member 41 are connected together and the planetary gear is locked so that it now rotates as a unit at the R. P. M. of the shaft 50 and transfers this same R. P. M. to the main shaft 20 of the transmission.

As will appear from the above the mechanism illustrated results in an advantageous transmission of power with advantageous torque conversion in the smallest space and with a minimum of running and shifting noise. By using a transmission with shaft trains interrupted at a number of points the desired number of speed ratios is obtained with a minimum number of gears. Operation of the device is comparatively simple and the operating reliability is materially increased by reason of the fact that the circulating circuit of the hydraulic torque converter remains always filled. It is unnecessary to completely empty the pressure chamber of the friction clutch on declutching so that the reengagement of the clutch can be effected in minimum time.

The advantages of this power transmission are, according to a feature of the invention, furthermore increased by the provision of an auxiliary energy device for actuating the change stages and also the friction coupling. The action of the friction coupling may be controlled by the driver or by an automatic device depending upon speed or number of revolutions and which after release gives without further control by the driver and by an automatic arrangement which is provided, a positive sequence of the operating process in the change speed gear and of the disengaging and engaging process of the friction coupling. Such devices are shown and described, e. g., in the U. S. patent specifications applications Ser. Nos. 30,759; 30,760; 160,916; 172,020.

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2 Sheets-Sheet 1

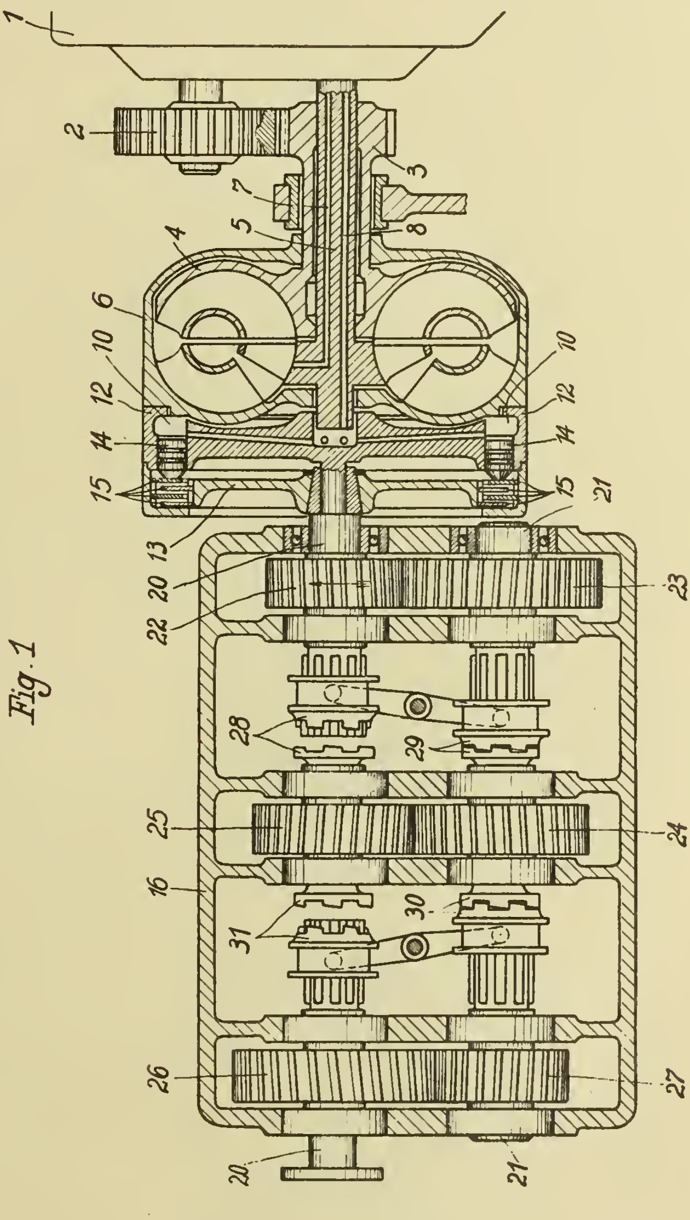

Fig. 1

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2 Sheets-Sheet 2

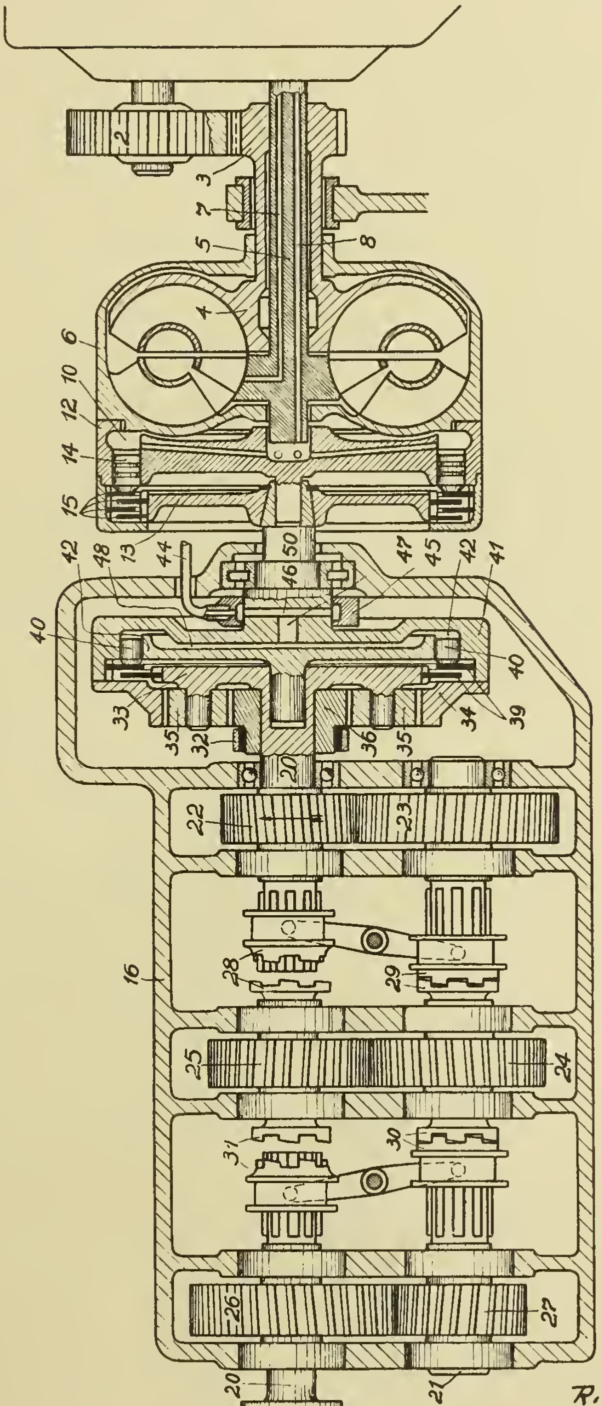

Fig. 2

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ALIEN PROPERTY CUSTODIAN

METHOD FOR PRESERVATION OF SOLID FOOD

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This invention relates to improvements in a method of food preservation and particularly to a packing method of solid food in a can of a large volume. The main object of this invention is to preserve a large mass of food in a can with a good sterilized condition.

When a food is preserved in a can, it is customarily sterilized by heat, keeping the packed can in a room with heating means for a certain length of time in accordance with the kinds of canned food and the volume of can. On account of this latter reason, the volume of a can cannot be so large, because, if the can has a large volume the inner portion of the food cannot be subjected to the heat of a sufficiently high for perfect sterilization, otherwise the outer portion of the food in the can is spoiled by too high or too long time heating. This is the principal reason that the volume of a can for sterilized good is restricted to a small one as one pound or thereabout, so that the cost of can and of working per unit volume of preserved food is high.

According to this invention some hundred or thousand pounds of food can be packed in one can in a good sterilized condition, and even a tank car for railway or other traffic can be prepared.

The can to be used to carry out this invention consists of a can body having a large volume and a removable lid for the body which can be airtightly fitted to the open end of the body and temporarily connected thereto by means of a tightening device or solder. Either of the body or the lid provides a hole, through which air is driven out and steam is supplied in the can, and the hole can be plugged at will.

Referring to the drawing, Figure 1 is a plan view of a can and Figure 2 is a sectional elevation thereof accompanying with an arrangement for packing. In the drawing, the lid **1** can be fitted to the open end of the can body **2** by means of a proper tightening device, which, according to the drawing, consists of bolts **3** with a hooked head which are loosely held on brackets **4** equidistantly provided on the periphery of the open end and nuts **5**. The lid is forced to an inner flange **6** of the body with a packing ring **7** when the nuts **5** are screwed on the bolts. There is a hole **8** on the body to which a short pipe **9** with a stop valve **10** and a joint **11** is screwed up. A header **12** for pipes is connected to the joint, and pipes **13**, **14**, **15** and **16** are connected to a vacuum pump **17**, a steam boiler **18**, a boiling pan **19** and an exhaust pipe **20**, respectively.

Another hole **21** is provided at the bottom of the can, and is connected to the boiling pan **17** by means of a pipe **22**. A three way cock **23** provided in the pipe **22** allows the can open to exhaust, if required.

In carrying out this invention, it is absolutely necessary to put the food in the can without liquid, and the food must be such one that a pretty clearance is left between each piece. On account of this reason, it should be understood that liquid, powdered, paste-like or plastic foods cannot be treated by this present invention. Fish or flesh should be cut into a large mass, say one to ten pounds, and is lightly boiled before it is placed in the can, whereby the outer part of the mass becomes hard so that the clearance around it is easily sustained.

When the required quantity of the food cake is placed in the can, the lid is placed on the open end of the body, and is closely fitted thereto by means of the tightening device. The bottom hole of the can is now closed and the interior of the can is connected to the vacuum pump **17** through the pipe **18**, so that the interior of the can becomes partial vacuum. Next, the pipe is closed and the interior of the can is connected to the steam boiler **18** through the pipe **14**. Steam is sent to the can for a proper length of time according to the kind of food and the size of the cake placed in the can. While steam is sent to the can, the bottom hole is open so as to take out the drain produced in the can.

If the drain contains valuable extract, it is sent to the boiling pan, and after sterilized, it is returned to the can when the sterilization of the can is finished.

According to this invention each food cake in a can is directly subjected to steam, so that sterilization of each cake is made in an equal condition independent of the volume of the can used.

Further in this invention the food is subjected to steam accompanying with no liquid, which however is considered heretofore indespensable as heat transmitting agent when a can is heated from outside. If liquid would be heated with cakes according to this invention, the sterilization would require a longer time than that when cakes only are heated, because the liquid prevents steam from direct contact with the food and much more heat is required for heating the liquid in the can.

In case solid food accompanys liquid matter, they are separated at first, and the solid portion only is placed in the can, and the liquid matter is taken to the boiling pan, thus the solid portion

and the liquid matter being separately sterilized by heat.

When the food in the can is perfectly sterilized the steam pipe is closed and the liquid and the extract placed in the boiling pan which have been also sterilized by boiling, are sent to the can. The pipes 9 and 22 are now removed from the can before the internal pressure of the can is still higher than the atmospheric one, and the holes 8 and 21 are airtighty plugged up. In order to quickly lower the internal pressure of the can before the pipes are removed, the exhaust pipe 20 may be opened so that the steam flows out from the can.

If the volume of the can is very large, or sufficient clearance around each cake cannot be expected, or the cake is of collapsible nature, it is advisable that some separaters are inserted in the can when the food is placed in it. Such separaters are held in the can until the food is taken out for use, therefore the material for the separater must be that which does not spoil the food nor is spoiled by the food during in stock.

The can of course must stand against the pressure of steam for sterilization and the partial vacuum produced in the closed can after cooled. For this purpose, the can body and lid may be strengthened by ribs, bands and other re-enforcing means.

This invention is favorablly applicable to preservation of a large quantity of fish or flesh which is consumed at a time by a large number of men or in a market just as they are preserved by refregeration.

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Fig. 1

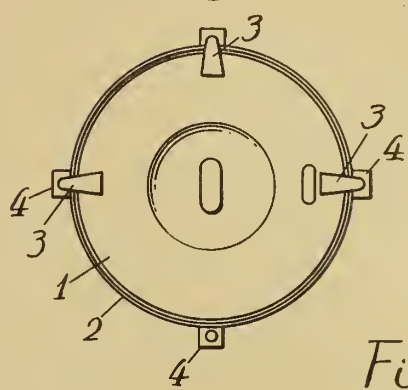
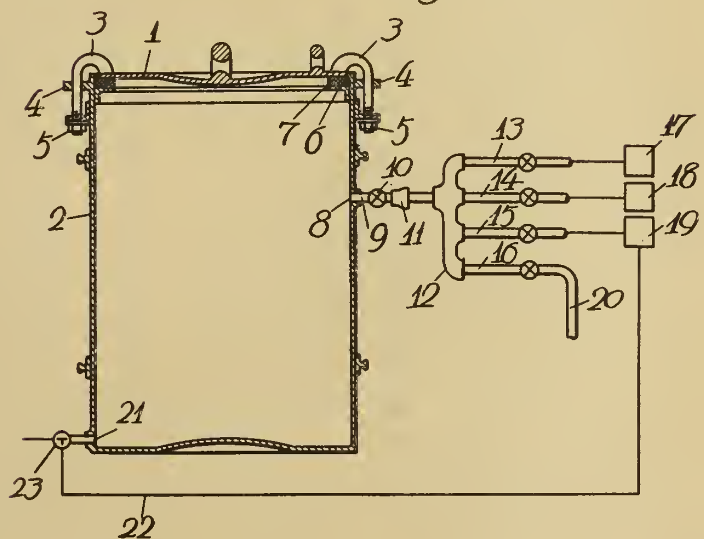


Fig. 2



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ALIEN PROPERTY CUSTODIAN

EDIBLE ICE, AND THE PRODUCTION THEREOF

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This invention relates to edible ice, which means in the following specification and claims, products such as ice cream, milk ice and sherbet taken for refreshment as well as—in some cases and for certain kinds of ice—for nourishing purposes. I wish it to be understood that the invention comprises all kinds of such products irrespective of the term or name connected thereto. To make this understood I use the term edible ice, which comprises such kinds of refreshment and nourishing ices whereas it is not intended to cover thereby the pure frozen water, cristal ice socalled. The term edible ice comprises soft ices as well as the hardened ices sold for instance in pails, boxes or the like containers or in cartons, packages, wafers, etc.

It is well known in the production of edible ice to add to the mass to be frozen stabilisers such as gelatine, agar-agar, pectin, and the like as well as yolk of egg in the fresh or desiccated state as well as milk powder or condensed milk. It has been found that particularly the two latter additions, viz. dry substance of egg-yolk and dry substance of milk will contribute to make the flavour of the finished ice rich and to obtain an improved expansion of the mass.

The improvement obtained by the addition of dry substance of egg yolk or milk, in view of the facts which will be explained in the following, must be assumed to be due to some extent to the face that yolk of egg and milk powder contain phosphatides which are surface active substances containing in their molecule groups that are lipophillic and aerophillic as well as groups that are hydrophillic.

By adding egg yolk or milk powder to the mass there is incorporated therein not only the surface active phosphatides but also other substances such as fats, proteins, sugars, salts and flavouring substances which in some cases is undesirable. Moreover the employment of yolk of egg or milk powder is rather expensive when nothing but the surface activity of these substances is made use of. Thus there must normally be used one egg yolk or 5 grms. dried yolk of egg for 1 liter of the mass to be frozen in order to obtain a substantial effect.

The object of the present invention is on the first hand the production of edible ices in which the taste is richer and more fatty and the texture is finer than in known ices, the expansion being at the same time as great or greater as in known ices the flavour of which is not so rich and the texture of which is not so fine and smooth.

A more special object of my invention is the production of an edible ice comprising a fat emulsion, the fat particles forming the dispersed phase thereof, sugar, a hydrophillic colloidal substance acting as stabiliser and flavouring substances, such edible ice having the properties mentioned above.

Another more special object of my invention is the production of an edible ice comprising sugar, a hydrophillic colloidal substance acting as a stabiliser and flavouring substances together with water, such edible ice having the properties mentioned above.

Further objects of my invention will appear from the following description.

With such objects and purposes in view the difference between the edible ices produced according to my invention and known ices and the difference between known methods of producing such ices and the methods according to my invention resides mainly in the fact that substances different from phosphatides and containing in their molecule groups that are lipophillic and aerophillic and groups that are hydrophillic are added to the mass to be frozen. Such substances in view of the presence of the said groups in their molecules are surface active or interphase active and act as dispersing agents for which purpose they are employed in many industries.

It has been found that by adding such dispersing agents which must be edible in the concentration in which they are to be employed the texture of the ice will be finer and more smooth and the flavour will be more rich and fatty. This will be the case even when the ice be expanded more than has hitherto been normal practice. The distribution of the air and of the ice cristals as well as that of the fat particles in the cases where fat is present will be finer. The use of yolk of egg may be dispensed with, if so desired, and the results that can be attained will be better than those obtained with egg yolk. If milk powder or condensed milk is otherwise added for dispersing purposes only, the addition thereof can also be dispensed with.

The mass from which edible ices are produced by freezing are normally emulsions of the type oil-in-water. The dispersed phase in many cases for instance in the case of cream ice, consists mainly or exclusively of the fat balls of the cream. Even in the case of other types of ices, for instance in the case of milk ice, emulsified fat may be present in the mass. On the other hand types of edible ices are known which are produced by freezing a mass which is not an emulsion of fat. Thus edible ice may be produced by freezing an aqueous solution of for instance fruit juice and sugar. In the mass of such edible ices as well as of that produced from emulsions of fat, hydrophillic colloids are normally present, for instance pectin substances, agar-agar or gelatine. By the expansion step of the production, however, air is incorporated in the mass which in some cases is also brought to contain carbon dioxide in the dispersed phase.

The product subjected to freezing and in some cases to hardening will accordingly in all cases be in the nature of a disperse system of the type oil-in-water or air-in-water or normally both oil-in-water and air-in-water.

For the dispersing agent such substances are accordingly preferably used which have in themserves the tendency of producing emulsions of the type oil-in-water and such dispersing agents will normally also be dispersing agents for air, the lipophillic group of such substances being at the same time aerophillic.

It is well known, however, that many dispersing agents can be successfully used in the production of emulsions of the type oil-in-water as well as in the production of emulsions of the type water-in-oil. Accordingly nothing will prevent employing in accordance with the present invention such dispersing agents as well as dispersing agents which are normally particularly suited for use in the production of emulsions of the type water-in-oil, provided that care is taken to see that the dispersion obtained is of the type oil-in-water and air-in-water. For this purpose the dispersing agent may be added to the mass to be frozen previous to or during freezing in the shape of a pre-emulsion or dispersion of the oil-in-water or air-in-water type. In the production of this pre-emulsion care is taken that the ratio between the proportions of fat and water is so as to be favourable for the formation of a dispersion of the desired nature and, if necessary, the production of such a dispersion is secured in other manners known per se, for instance by suitable mechanical and physical influencing.

In many cases, for instance in the case when monoglycerides are used for the dispersing agent it has been found that the melting point is of importance, the results obtained being the better the higher the melting point within reasonable limits.

The explanation of this fact is presumably that that the melting point of the dispersing agent shall preferably be higher than or in the vicinity of the temperature at which the mass or the pre emulsion is subjected to the substantial part of the treatment by which the dispersion is obtained or brought into the desired degree of dispersity which treatment is normally a process of the kind called homogenizing. The emulsion in this case will be prevented from forming or returning to a water-in-oil emulsion by the complete or partial gelation of the films produced round the balls of fat. The said selection of the melting point of the dispersing agent may therefore be considered a precaution to secure the formation of dispersions of the type oil-in-water.

In some cases this purpose can also be attained by employing a lower homogenisation temperature than usually.

In the following the employment of a number of different dispersing agents is described in connection with the production of edible ices of three different types, the manner in which the mass is prepared and the manner of expanding and freezing it as well as the kind and proportions of the ingredients of the mass being similar in the case of a great number of the dispersing agents mentioned in order to render possible a comparison of the effect of the same. It goes without saying that the invention is not limited to the specific operations described or the order of succession thereof or the specific ingredients or proportions mentioned.

An evident variation of the method described is the employment of ice cream powder by which cream, milk or water has added to it the other constituents of the mass to be frozen in the shape of a powder. This powder will thus contain for instance dry substance of milk together with sugar, gelatine, algine or other protective colloids and flavouring substances and carbon-dioxide-producing constituents, if so desired. Evidently, according to the present invention, the dispersing agent may be present in the ice cream powder, but preferably such dispersing agents are to be used which tend to produce oil-in-water emulsion, i. e. especially the dispersing agents mentioned in Example I.

The precautions mentioned in the example and serving to improve the fineness of the emulsion, viz. the homogenisation, are not indispensable, the use of a dispersing agent causing the dispersion to be finer, even when thesc precautions are not made use of.

Example I

A cream mixture corresponding to what has been termed mass in the preceding part of the specification is produced from:

	Kgs.
Cream	200
Sugar	14
Condensed milk	24
Gelatin	1,5

Colour and flavouring substances, suitable quantities.

Dispersing agent as indicated below.

The mixture is passed through a homogeniser at 60–70° C. and the homogenised mixture is left to stand for maturing at low temperature, preferably 2–4° for 24 hours. In place of the homogeniser other means for improving the emulsion with respect to its stability and the size of the dispersed particles may be used.

After maturing the mass is introduced into an ice-cream freezer which is a container surrounded by a cooling jacket and mounted with a rotating whipping and scraping member. In this freezer a certain portion of the mass at a time is treated for a period of 6–20 minutes with a cooling medium of —20 to —35° C. being passed through the jacket and the treatment is discontinued when the desired consistency and temperature has been attained. The portion of the mass introduced in the container at the commencement of the treatment will fill the same partially only but during the treatment the volume will increase owing to the expansion or swelling, so-called.

After the treatment in the freezer the mass is introduced into pails or moulds which are frozen and hardened for 24 hours at 120 to —25° C. except in the case of soft ice when this freezing and hardening is dispensed with.

For the purpose of comparison five masses in which the contents of dispersing agent are as follows are frozen in the manner described above.

	Per cent
(*a*) No dispersing agent	
(*b*) Dried yolk of egg	0,5
(*c*) Sodiumcetylsulphate	0,1
(*d*) Monostearic acid triglycerin	0,2
(*e*) Mixture of 50% monostearic acid glycerin and 50% monostearic acid diglycerin	0,3

During the treatment in the freezer the same expansion was aimed at in all five cases, viz.

100% but this degree of expansion was obtained only with difficulty in case (*a*) when no dispersing agent was added. In the other four cases (*b*)–(*e*) it was easily obtained.

The quality of the product obtained was decidedly better when egg yolk was used than without egg yolk. In the three experiments (*c*)–(*e*) in which a synthetic dispersion agent has been used, the quality was still appreciably better than in the case of yolk of egg. The consistency may be characterised in the following manner.

(a) Watery and rather spongy.
(b) Smoother and more rich in flavour.
(c) Smooth, velvety and of a more fat taste.
(d) Similar to (c).
(e) Smooth, velvety, very rich and fat in flavour.

The improvement is partially due to the fact than can be found at microscopical analysis that the dispersion of the bubbles of air is finer and that the fat is present in more balls of smaller size.

Generally the result will be further improved when the dispersing agent is homogenised together with only a small part of the mass which is then added to the balance of the mass when the same has been homogenised.

Example II

A dispersing agent is added to a mass of the same composition as in Example I, in the following manner.

The dispersing agent is added in the molten state at 70–80° C. or in the shape of a powder or a paste formed with water and in the proportion stated below to 5 litres of the mass at 65° C. After the dispersing agent has been preliminary dispersed by whipping or agitation the mixture is passed for 10 minutes through a homogeniser at 200 atm. when it will have passed several times through the pressure head of the homogeniser.

After homogenisation the pre-emulsion is cooled to 20° C. and added to the balance of the mass which has in the meantime been homogenised. This homogenisation may be dispensed with, if so desired. As dispersing agent one of the substances or mixtures stated below is added in the proportion stated.

	Per cent
(*a*) Monopalmitic acid diglycerol	0,2
(*b*) Monopalmitic acid glycerol	0,4
(*c*) Mixture of 9 parts monostearic acid diglycerol and 1 part sodium salt of monosulphoacetic acid monopalmitic acid glycerol with 10 parts of water to form a paste	0,5
(*d*) Monostearic acid polysaccharide from dextrine	0,2
(*e*) Monostearic acid saccarose	0,2
(*f*) Monostearic acid glycose	0,2
(*g*) Mixture of 9 parts monostearic acid glycerol and 1 part stearate of lys-albic acid with 10 parts of water to form a paste	0,5
(*h*) Pentahydroxyethylether of monostearic acid sorbitol	0,2
(*i*) Sodium salt of monopalmitic acid monophosphoric acid glycerol	0,2
(*k*) Monoglyceride of slightly oxidised, partially hardened fatty acid of soy oil	0,2
(*l*) Monoglyceride of hardened fatty acid of castor oil	0,2
(*m*) Stearic acid aminoacetic acid monoglyceride	0,2

From the mixture a cream ice is produced in the manner described under Example I, the result being in all cases that the product is of finer texture and richer and more fatty in taste than when no dispersing agent of the kind described is used. Moreover the expansion of 100 per cent aimed at is obtained with facility, contrary to the mixture when no dispersing agent is present of the kind described. Even a degree of expansion of 110–120% is readily obtained without the texture and flavour being influenced.

Example III

The mass is of the same composition as stated in Example I, except for the cream which is replaced by the same proportion of milk.

For the dispersing agent are employed for instance the following substances which are added in the manner stated in Example II:

	Per cent
(*a*) Monostearic acid glycerol	0,5
(*b*) Monostearic acid diglycerol	0,3

After expansion freezing and hardening in the manner stated in Example I a milk ice is obtained. The difference between such milk ice prepared without dispersing agents and with dispersing agent of the kind stated is even more appreciable than in the case of cream ice.

Example IV

For the production of water ice (sherbet) a mass of for instance the following constituents is prepared.

	Kgs
Juice of raspberry (whole raspberries crushed with 50% sugar)	15
Sugar	8
Water to dissolve sugar	4
Water	26
Gelatin	0,2
Water to dissolve gelatin	2

In accordance with the invention a dispersing agent is added, for instance 250 grms. monostearic acid glycerol mixed with 2 kgs water.

The mass is frozen as stated in Example I with the exception that the expansion is only about 50%, so that 30 liters of ice are obtained from 20 liters of the mass. Without dispersing agent only 25% expansion can be obtained with the same mass i. e. 25 liters of ice from 20 liters mass. The ice in which a dispersing agent is present, is moreover of a finer crystalline texture, and when the ice is moulded with a stick in it, it will fasten better to the stick.

In the types of edible ice given in Examples I–IV various flavouring substances may be substituted for the ones mentioned. Moreover, the invention may readily be employed with other recipes, thereby obtaining similarly favourable results. Thus the invention may be employed in connection with the types of ice frozen in the presence of dissolved and dispersed carbon dioxide, irrespectively whether it is added in the freezer or already present in the mass.

In each of the examples given the dispersing agents mentioned in the other examples may be used with the exception that not all of the dispersing agents mentioned in Example II can be added directly as mentioned in the first part of Example I.

Similarly other dispersing agents may be used in the examples described as well as with other recipes or types of ices, thereby obtaining similar results.

Synthetically produced dispersing agents, fulfilling the conditions of being used according to the present invention in that they contain at least one hydrophillic group and at least one lipophillic group and in that they are not poisonous and taste-spoiling in the concentration in which they are to be used, are to be found in very great number on the market and a still greater number is described in literature. Such substances are used to a great extent in the production of dispersions of widely varying kind, for instance cosmetical or pharmaceutical emulsions, emulsions of fat to make substitution products to replace milk or cream or to make auxiliary means for bakery purposes in the production of margarine as detergents as wetting agents, in the textile industries or for other purposes, for the production of foam etc.

It is not possible giving a compendiary description of all possibilities of composing such substances, and no grouping can be, so far, be given comprising all such substances. Accordingly the following statements when they are general in form as well as when particular chemical individuals are mentioned shall not be taken for an exhaustive definition or enumeration of said substances but they are given for guidance only and are preferably chosen among the groups which are so far of the greater importance.

For the lipophile groups there may be used higher fatty acid or higher fat alcohols or the derivatives thereof soluble in fat or, somewhat more generally, hydrocarbon chains or rings soluble in fat.

Examples of hydrophillic groups that may be used in the composition of the dispersion agent are acid groups, which may be neutralised or not, hydroxyl groups and amino groups. Thus the following group are very active: sulphuric acid groups or phosphoric acid groups or free hydroxyl groups in divalent or polyvalent alcohols or the derivatives thereof or in sugars, such as monosaccharides, disaccharides, trisaccharides and polysaccharides or hydroxy alkyl ethers, in which free hydroxyl groups are present in the alkyl etherified with the alcohol. Even the hydroxyl group of higher monovalent alcohols, for instance cetyl alcohol, are effective to some extent. In this latter compound the hydrophillic group is bound directly to the lipophillic group but the hydrophillic and lipophillic groups may be connected in many other ways among which condensation, etherification, esterification, connection through an oxygen bridge and connection through nitrogen-containing groups as for instance in amino acids may be mentioned. Also oxygen groups and peroxide groups are hydrophillic.

In lipophillic groups connected to hydrophillic groups other hydrophillic groups may be introduced, for instance the oxygen group produced in an unsaturated fatty acid chain by blowing the substance in which it is contained at a suitable high temperature with an oxygen-containing gas. Other examples are sulphonic acid, sulphuric acid, phosphonic acid or phosphoric acid groups that may be neutralised or not. Moreover the fatty acid chain of an oxy acid may be used for the aerophillic and lipophillic group.

In the examples monopalmitic acid and monostearic acid glycerol are mentioned as excellent dispersing agents for the present purpose. The same applies to other monofatty acids glycerols in the case of higher fatty acids. It is also mentioned that monofatty acid diclycerol and triglycerol are effective and this applies also to monofatty acid polyglycerol.

In the production of these substances alkali salts, particularly sodium or potassium salts of fatty acids are commonly employed for catalytic purposes, even salts of the lower fatty acids, for instance sodium acetate. Accordingly such salts will frequently be present in small proportions in the dispersing agents in question, for instance in a proportion of abt. 2% of the dispersing agent. The alkali salts of the higher fatty acids, for instance sodium stearate, are moreover dispersing agents which in themselves may be used according to the present invention, provided that the proportion thereof is so small that it does not spoil the taste of the product. Just as glycerol in which one or two hydroxyl groups are left free glycol in which one hydroxy group is left free and the derivatives thereof for instance di-, tri- and polyglycol may advantageously be used for the hydrophillic group of the dispersing agent. Excellently suited is for instance monofatty acid, triethylene glycol. When a hydroxy compound having more than two alcohol groups of which at least one is left free is used, the other alcohol groups may be esterified with the same or different lipophillic acid groups.

Among the groups that may be used in the lipophillic part of the molecule of the dispersing agent sterols, such as cholesterol, may be mentioned as well as hydro carbons which are derivatives thereof and soluble in fat.

When lysalbic acid is mentioned among the examples it must be understood that amino acids and the decomposition products of proteins are generally strongly hydrophillic and they may, therefore, be used in the hydrophillic part of the molecule of dispersing agents for the present purpose.

The finer distribution of fat, if present, and of air causes the walls of the air particles to be thinner. In some cases, therefore, it will be necessary to strengthen them, which can be done by adding a stabiliser or increasing the proportion of stabiliser which would otherwise have been used. The dispersing agent may also be used in mixture with a stabiliser such as gelatine, algine, agar-agar, pectine etc. in a proportion suitable to compensate for the deficiency in stabiliser produced in the addition of the dispersing agent, as explained above. Example: equal parts of dispersing agent and stabiliser to 2 parts of stabiliser to 1 part if dispersing agent.

ANDERS HERLOW.

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ALIEN PROPERTY CUSTODIAN

SYSTEM OF TREATING SURFACES OF REFLECTORS AND SIMILAR ARTICLES

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Application filed September 25, 1939

This invention relates to a method of treating surfaces of metallic reflectors, screens, or the like, for instance, for cinematograph projection.

It has already been proposed to produce reflecting surfaces on articles of the kind described by brushing, and it has been found that the optical quality of such surfaces is determined by the method of treating them. In order that the surface should be perfect, it must possess a definite degree of fine-grainedness and uniformity. No method had as yet been found to produce these properties systematically, that is, in such a manner that they will be imparted to all work pieces treated.

It is desirable that the small flutes or grooves which are formed in the surface of the reflector by brushing should be in a vertical position, since the reflecting surfaces are also positioned vertically, and therefore it has been proposed to use narrow brushes producing narrow, juxtaposed brushed bands, because flutes or grooves extending all over the surface and forming single units, cause interference.

It was believed that overlapping of the individual narrow bands was favourable for effecting diffused distribution of rays in horizontal direction, because the overlapping produces strips which are alternately comparatively light and comparatively dark. Overlapping also eliminates interference to a considerable extent.

However, it has been found that overlapping of the bands produces corresponding bands in the projected picture, and therefore must be avoided.

It is an object of the present invention to provide a method of treating the surface, for instance, of a plate or disk of aluminium, so that overlapping of the bands is eliminated.

If it is desired to use narrow brushes for the purpose aforesaid, the bands are produced by slight pressure of the brushes or by brushes having soft bristles. In this manner, the bands are formed in juxtaposed and superimposed relation and only a slight action of the brushes is effected.

In a particular embodiment of the invention, the projection surface is treated with brushes whose length is at least equal to the largest dimension of the surface.

According to another embodiment of the invention, rotary brushes may be used which alternately rotate in opposite directions.

The treatment produces considerable quantities of dust which may interfere with the treatment of the surface. Such interference is prevented by removing the dust by any suitable means, for instance, by a blower, or a suction apparatus.

The reflectors or screens which may be of aluminium, zinc, tin, silver, iron, or of alloys of these and other metals, or of any other suitable substance, or are coated with such substance, are thoroughly cleaned and grease is removed, for instance, by washing with trichlor ethylen. The cleaned surface is then treated with brushes having fine bristles of steel wire, for instance, of 0,1 mm diameter.

When it is desired to treat large surfaces without overlapping, it is possible to use narrow brushes with soft bristles and to move these over the surface under slight pressure so as to place the strips side by side. Another possibility is that of using brushes whose length is at least equal to that of the largest dimension of the reflector or screen. In a rectangular reflector this is normally the horizontal side. The brush is positioned in parallel relation to this side and is moved over the entire surface in a direction at right angles to this side. Preferably, the brush is as long as, or somewhat longer than, the said longer side of the rectangle. For instance, for a screen which is 30 feet long, the length of the brush is substantially equal to 30 feet.

The drawing illustrates one mode of carrying out the invention, in a plan view upon the surface to be treated, with a brushing device operating on the said surface. As shown, a brush **1** including steel bristles **6** is placed on a surface **2** of a plate or sheet of aluminium or the like, parallel to the longer side of the said sheet and moved across the surface by means of a holder **3** having handles **7**, in the directions of the arrow **4**, thus forming small flutes or grooves which are indicated at **5** or an exaggerated scale. As shown the brush is somewhat longer than the longer side of the surface to be treated, so as to extend beyond the edges of the same.

With reflectors of the length aforesaid, that is, about 30 feet, it is also possible to employ rotary cylindrical brushes if it is desired to distribute the light principally in upward or in downward direction, as required, for instance, in a cinema with respect of the level the seats are arranged at. For uniform distribution in upward or downward direction, the brushes are rotated alternately in opposite directions, or the reflector is turned upside down while the brushes are rotated in the same direction. In the case of reflectors that are comparatively long, rotary brushes have the advantage that they remove the dust consid-

erable amounts of which are produced in long reflectors.

Care must be taken that depressions are not formed in the brushes which may occur if a brush is handled roughly, for this would produce bands in the surface. To obviate defects of this kind which are rather troublesome in larger surfaces, plane brushes of considerable length are used. For instance, a brush 1 as illustrated which is 3 ft. long, should be 3/8 to 13/16 in width.

In long and wide brushes, a considerable amount of dust collects below the brush. Part of the dust is removed as the brush reciprocates and the remainder is removed by a blower or suction apparatus.

There are brushes which may be considered as forms intermediate between rotary cylindrical and plane brushes but can be allotted to one or the other form. The operation, however, is the same, that is brushing without overlapping of the bands.

The surfaces to be treated may be smooth, or they may be subjected to any kind of preliminary treatment for roughening them, for instance by pickling, etching, sand blasting, etc., and they may be produced by spraying metal against a suitable bearer. Such bearer may also be a metal fabric.

Instead of being brushed, the surfaces may be ground by grinding stones or emery wheels, or even sand blasted, but under all conditions there must be no overlapping, and the flutes or grooves must be formed uninterruptedly. With the present state of the art, brushes are preferred because with them it is easiest to produce large surfaces of excellent optical properties.

Surfaces which had been treated with brushes in the manner as performed heretofore were not adapted in practice, as they had overlaps and the operating conditions were not known, especially for projection screens of large size and uninterrupted surface unit.

By the invention, a surface is produced which is optically perfect and in which the grain of the metal surface is exposed while at the same time the individual particles are fluted or grooved in the direction of brushing.

GUSTAV KÖGEL.

PUBLISHED

MAY 4, 1943.

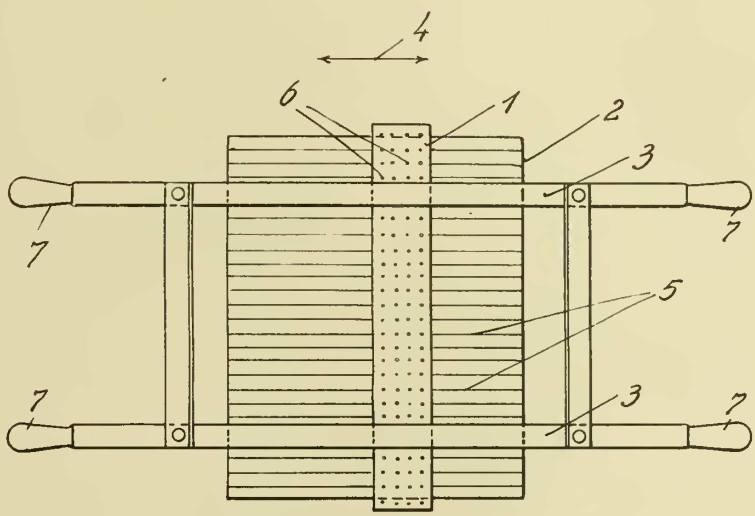
BY A. P. C.

G. KÖGEL

SYSTEM OF TREATING SURFACES OF REFLECTORS AND SIMILAR ARTICLES

Filed Sept. 25, 1939

Serial No. 296,483



Inventor:
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Published May 4, 1943 Serial No. 297,878

ALIEN PROPERTY CUSTODIAN

ANEMOMETRIC ANTENNA FORMED WITH TWO PITOT TUBE INTAKES, OPPOSITELY DISPOSED, FOR MEASURING THE INDICATED VELOCITIES OF AIRCRAFTS

Augusto Baroni, Rome, Italy; vested in the Alien Property Custodian

Application filed October 4, 1939

It is known that the measure of the "indicated velocity" of an aircraft, which corresponds to the measure of its lift, is now normally effected with instruments of the type of the differential manometer, connected with an intake antenna, which comprises almost generally a Pitot tube associated with a static pressure intake. The antenna is usually secured in a suitable position at a certain distance away from the leading edge of the wings, taking care that the intake is placed at a point which is influenced as little as possible by the reactions due to the movement.

However, although it is possible to obtain correctly the total pressure, which is the sum of the static and of the dynamic pressures, even in the proximity of the lifting surfaces owing to particular devices for causing the Pitot to be non sensitive to substantial variations in the direction of the stream (which has been obtained by inserting it inside a larger tube suitably shaped) it is sufficient that the intake is effected in a zone in which the speed potential has a constant ratio between the total pressure and the velocity, according the Bernoulli's law.

However, it has not been possible up to the present, to eliminate in a permanent manner the disturbing action of the velocity on the static intake, so that in some cases, it has been proposed to provide an antenna suspended from a hollow cable so as to bring this intake to a zone in which the disturbances caused by the movement of the aircraft are partially or totally absent. However, apart from unfavorable local conditions, the difficulty for obtaining an efficient static intake in aviation, is particularly serious, because, as regard the troposphere, and the velocities to be considered at the present day, the static pressure is always substantially greater than the dynamic pressure, so that if the measure of the total pressure is taken to be accurate, an error of only 1% in the static pressure intake, produces a much greater error in the differential determination of the dynamic pressure, (and consequently of the indicated velocity), which error, varying in decreasing relation with the velocity, may assume values from 3% to 300%. Consequently, the inherent simplicity of the Pitot tube, used in hydraulics for over two centuries, is thus seriously compromised in areonautics relatively to the static pressure intake.

The present invention is intended to eliminate the static pressure and the serious inconveniences thereby caused when using it on aircrafts, and is based on the principle of the known double Pitot tube used in hydraulics, taking however into account the particular aerodynamical conditions which tend to complicate the problem to be solved. The problem is solved, according to the invention, generally by placing two Pitot heads oppositely disposed with respect to one another, inside a guide tube adapted to convey and to regulate the air stream so as to fulfill the following conditions;

(1) To insure the total pressure intake substantially independently from the actual direction of incidence;

(2) To form a field of velocity potential near the countercurrent intake of the first Pitot tube;

(3) To reproduce another field of velocity potential, in a section further down, near the exit, in the direction of the stream of the second Pitot tube placed in opposition, after the other Pitot tube;

(4) To provide a communication between the two Pitot heads, respectively with the two compartments in a tightly closed box, separated with an elastic membrane acting as sensitive element of a differential manometer.

The general shape of the guide tube, is similar to that of a Venturi tube; said guide tube is cylindrical on its outer surface, and is provided inside with a cylindrical central middle portion, merging at both ends with conical profile, the two Pitot intakes being placed each inside said conical profile, so that the corresponding free sections of the guide tube may have equal areas. By means of tests in the wind tunnel, it is possible to determine the most suitable conical profiles and any other dimension of the device in relation with the diameter of the intake. Theoretical considerations, assisted by practical tests, are favorable to the positive results obtainable, as well as to the possibility of reproducing in series construction the antenna according to the invention, thus eliminating the necessity of individual calibration.

It is possible consequently to manufacture for aerial uses, a device similar to the double Pitot tube well known in hydraulics. Said device being adapted for measuring the indicated velocity in relation to the difference of pressure in the two Pitot tubes, without the use of static intakes. In fact, in the first of these tubes, placed in countercurrent, the total pressure P, is equal to the static pressure P_3 plus the dynamic pressure P_d, generally multiplied by a coefficient K; while the second tube disposed in the direction of the stream, gives a pressure P_2, which is equal to the static pressure P_s, minus the dynamic pressure P_d, mul-

tiplied by the same coefficient K. Consequently, the difference $P_1—P_2$, which may be measured with a differential manometer or other equivalent instrument, has the value of $2kp_d$, which may be immediately traduced for showing the indicated velocity, while the static pressure P_s is neutralized and has no influence on the measure. It must be observed that the differential manometer operates with pressures which are at least twice as much the pressures acting in the present instruments provided with a Pitot static antenna, which allows, in addition to a greater resistance to be assigned to the operating elements, a greater accuracy in the working of the indicator, even at slow speeds. It may also easily be proved that if the registration of the total pressures P_1 and P_2 was subjected to errors comparable to those to which is subjected the static pressure obtained from the velocities indicated with the antenna according to the present invention, would generally be of an order considerably smaller.

The form of construction of the present invention shown schematically in the accompanying drawing comprises an anemometric intake antenna with a double Pitot tube, connected to an indicating instrument.

The tapered body **I** is traversed longitudinally by a cylindrical bore, which in the middle is provided with a diaphragm **2** forming two closed end sections **3′**, **3″**, acting as Pitot tube heads opposed to one another. A tubular casing **4** which in the inside has a smaller diameter central portion merging towards the end openings with conical profiles having different inclinations, serves to capture the air stream substantially independently with respect to the effective direction of the outside stream, and to convey said stream so that in the neighborhood of the free ends of the two Pitot heads, the same axial dynamic pressure is present, directed axially in the direction of the relative movement. The tapered body **I** is rigidly fixed to the tubular casing **4** by means of a support **5**, in correspondence to which the casing is provided with a supporting arm **6** adapted for fixing the antenna to the aircraft. Both the support **5** and the arm **6** have streamlined profiles so as to oppose the minimum resistance to the air current. These parts, as well as the tubular casing **4**, are traversed by the tubes **7′**; **7″** providing communications between the Pitot heads **3′**, **3″**, respectively with the two compartments **8′**, **8″** of the tightly closed chamber **8**, provided with a separating elastic membrane **9**, Chamber **8** thus provides an element of a differential manometer, in which the deformations of the membrane **9** are amplified by means of an amplifying mechanism, and caused to rotate an index finger moveable on a graduated dial. At any point along the tubes **7′**, **7″**, for example, before the point of insertion of these tubes to the indicating instrument, said tubes are connected together by a tube **10** provided with a cock **11**, for opening or closing at will the communications between said tubes **7′** and **7″**.

Supposing that the relative movement of the air with respect to the intake antenna, takes place in the direction indicated by the arrows and that the cock **11** is closed, in the tubes **3′**, **7′** and in the compartment **8′**, the pressure P_1 will obtain, the compartment **8″**, there will be the pressure $P_2=P_3-kPd$. The membrane **9** will consequently tend to bend itself towards the compartment **8′** to an amount such as to balance the elastic forces developed by it with the pressure increase $P_1-P_2=2k.Pd$, existing in the compartment **8′**, while the static pressure, which is present on both sides of membrane **9** is neutralized. If now the cock **11** is opened, thereby causing tubes **7′** and **7″** to comunicate with one another, through the tubes **3′**, **7′**, **10**, **7″** and **3″**, an air current will be created, and in both compartments **8′**, **8″** of the chamber **8**, the pressure:

$$\frac{P_1+P_2}{2}=P_s$$

will obtain. By setting now the index finger of the differential manometer to zero, it will remain in this position whichever is the velocity of the stream. This is an essential condition to which the antenna according to the present invention must comply. On the other hand, the possibility of passing through the two Pitot heads a stream of air which produces a strong scavenging action therethrough, provides a very efficient means for preventing the formation therein of dangerous obstructions.

The two oppositely disposed Pitot heads, instead of being combined into a single tubular casing, may also be arranged as two separate antennaes, each of which comprises a Pitot head provided with a suitable tubular casing, having its own support and a suitable tubing; in such case said two antennaes must be mounted opposite one to the other, and at such distance from each other as to avoid mutual interference. The tubings leading from these antennaes, will be connected to the indicating instruments as above described, and the operation of the whole unit is identical with that of single antenna, which latter however, is to be preferred for practical considerations.

In the form of construction illustrated in the accompanying drawing, the operation of the cock **11** may be effected by the diaphragm **2**, by making this latter moveable, or by controlling said cock from a distant point by means of an electromagnet.

AUGUSTO BARONI.

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A. BARONI
ANEMOMETRIC ANTENNA FOR AIRCRAFT FORMED WITH TWO OPPOSITELY DISPOSED PITOT HEADS
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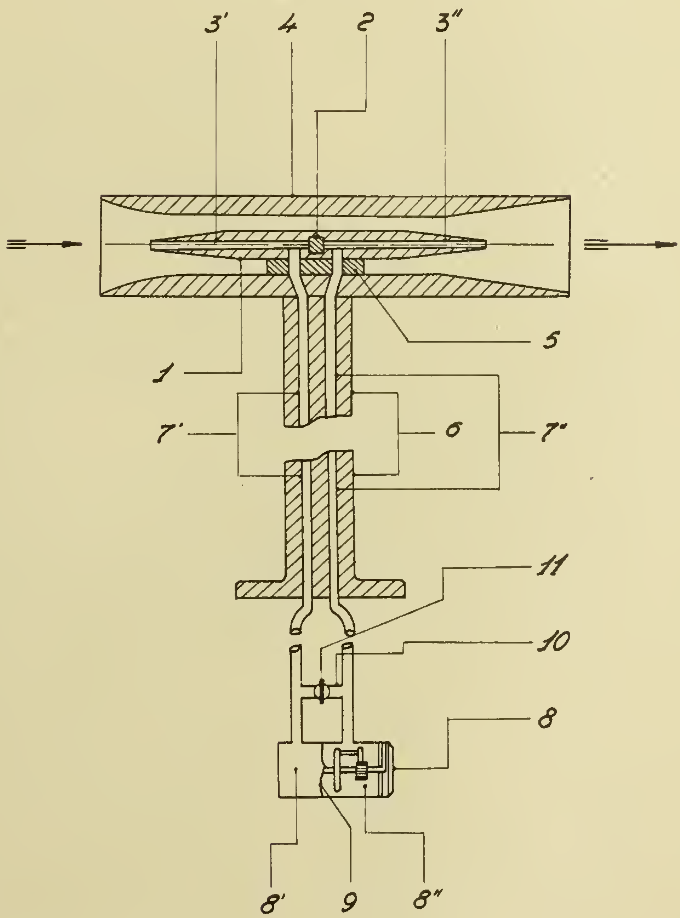

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ALIEN PROPERTY CUSTODIAN

INSULATED WIRE AND METHOD OF MAKING THE SAME

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No Drawing. Application filed October 7, 1939

Our invention relates to wires having an insulating layer of a lacquer material, and to a method of forming such layers.

Our invention is particularly important for the so-called lacquered lead wires, for instance telephone connecting wire, which must have certain electric properties such as high insulation resistance, low dielectric losses, and a low sensitivity from a dielectric standpoint to moisture and water.

Such lacquered wires are generally made by applying several layers of lacquer with intermediate drying of the layers. More particularly, the wire is passed through several baths of the lacquer in the form of a solution, and between the baths it is subjected to a drying in air, if necessary with a gentle heating.

We have found that such a method is not satisfactory when using lacquering materials from which it is difficult to remove the solvent, for example materials which contain a lacquer substance, such as chlorinated rubber, in addition to the necessary softening agents and solvents. More particularly, we have found that when using such materials it is difficult to make the lacquer layer sufficiently dry and hard, even if one uses for the lacquer substance very volatile solvents, such as benzene or a mixture, for example, of 90% acetone and 10% benzene. If one tries to obtain the desired hardening by excessively reducing the speed at which the wire is passed through the lacquering machine, the cost of production is increased, and if a high temperature is used in the process of drying the wire, such for example as 70° C., bubbles and bladders are formed in the lacquer layer, which deleteriously affect the electrical properties of the layer. Furthermore, drying at a high temperature causes the lacquer layer to become so sticky and soft that there is the danger that the layer will stick to the guide wheels and that the lacquer layer will be damaged.

The main object of our invention is to overcome the above difficulties when using lacquering materials of the above type, and to provide a method by which it is possible to form from such materials layers which have satisfactory electrical properties.

In accordance with the invention we apply a plurality of lacquer layers to the wire and between the application of the layers we dry each preceding layer only superficially in air. After all of the desired layers have been applied, we remove the residual solvent from the composite layer by slowly increasing the temperature of the layer from room temperature to a higher temperature. This increase in temperature may be effected either continuously or in steps.

When using the stepwise or continuously increasing heating according to the invention, the solvent moves by diffusion to the surface of the composite lacquer layer and is vaporized at that point. If the invention is not employed and it is attempted to completely volatilize the solvent by merely giving the layer a high temperature, i. e. quickly bringing the layer to a high temperature, bubbles will be formed in the material during the heating. This is caused by the fact that the solvent would not have sufficient time in which to move by diffusion to the surface, and instead forms bubbles within the lacquer layer.

The lacquer layer according to the invention is hard throughout, does not contain gas bubbles and is not mechanically damaged. Furthermore, adhesion, sticking or damage are avoided because the solvent is removed simultaneously with the increase in temperature, which prevents the lacquer material from becoming excessively soft.

The speed at which the temperature of the layer is increased and the temperature to which the composite layer is heated depends upon several factors, such as the thickness and the composition of the layer.

In the case of a continuously-increasing temperature, we prefer to heat the layer from room temperature to a temperature of about 50° C. to 60° C. at a rate increasing with increase of temperature about 2° C. and 20° C. per hour.

Highly satisfactory results are obtained when carrying out the heating according to the invention with a stepwise increase of the temperature of the composite layer. For example, the temperature of the layer is increased from room temperature to about 30° C. and allowed to remain at the latter value for a few hours. The temperature is then increased to about 40° C. and allowed to remain at this value for several-hours. The temperature is then increased to about 50° C., and allowed to remain for about one hour at that value, after which the layer is given a temperature of about 60° C. for about half an hour. In such a stepwise method the increase of the temperature from one step to the next can be effected rapidly. It will be observed to one skilled in the art that the progress of the heating stretches can be correlated to circumstances, such as the lacquer material and solvents used and the thickness of the lacquer layer.

In carrying the invention into effect in a continuous manner, the conductor with the compos-

ite lacquer layer thereon may be passed continuously through a long furnace which may be divided into compartments each having a certain temperature. However, to avoid the use of such a long furnace a semi-continuous method may be used.

In the semi-continuous method the application of the lacquer layers is effected in a continuous manner by passing the wire through several baths of the lacquer material with intermediate air drying. After leaving the last bath the coated wire is dried at a temperature of below 40° C., which places the lacquer layer in such a condition that the wire can be passed over guide wheels without damage, but the layer is so soft that the wire cannot be coiled on a reel. The wire is then passed over a set of guide wheels which are spaced a considerable distance apart in order to allow a long length of wire to be suspended therefrom. After the required length of wire has been placed on these guide wheels, additional lengths of the coated wire may be suspended between further sets of guide wheels.

While the wire is suspended between the guide wheels the lacquer layer is hardened or aged, and for this purpose we may pass through the wire a current which is of such intensity that the layer is heated to the desired temperature. During the time required to complete the drying and hardening, this current is increased in such a manner as to increase the temperature of the coating either in steps or continuously to the desired value.

We wish it to be understood that we do not desire to be limited to the examples and applications used in describing the invention, for obvious modifications will occur to a person skilled in the art.

JOHANNES HOEKSTRA.
JOSEPH EUGENE HUBERT RIETER.

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ALIEN PROPERTY CUSTODIAN

ROLLFILM CAMERAS

Heinz Küppenbender, Dresden, and Heinrich Eyth and Eugen Jörg, Stuttgart, Germany; vested in the Alien Property Custodian

Application filed October 6, 1939

The invention relates to improvements in rollfilm cameras and particularly is directed to rollfilm cameras in which the film advancement is controlled by an automatic locking device. In cameras of the type mentioned it is impossible to determine from the exterior whether the camera is loaded with a film, because there is not provided any means, as for instance a window in the rear wall of the camera casing, which would permit the photographer to detect the presence of a film in the camera.

The principal object of the invention is to overcome this disadvantage of the cameras mentioned by providing an interior portion of the camera casing, which interior portion is covered by a film in the camera, with a mark or sign, which is visible through a special observation window in the rear wall of the camera, provided there is no film in the camera casing.

Another object of the invention is to provide the observation window in the rear wall of the camera casing with a slidable closure member which normally is urged by spring pressure in a position in which the window is closed.

Still another object of the invention is to arrange the mark or sign, adapted to be visible through said observation window when there is no film in the camera, on the frame member which is positioned in the focal plane and surrounds the picture window of the camera. The mark or sign may consist of a white circle or a white cross, so as to be readily distinguishable through the window which is suitably colored to protect the light sensitive layer or the film, as is well understood in the art.

Other objects of the invention will be apparent from the following description with reference to the accompanying drawing which illustrates by way of example one embodiment of the invention.

In the drawing:

Fig. 1 is a rear elevation view of a rollfilm camera and illustrates the observation window and the slidable closure member for the same, and

Fig. 2 is a rear elevation view of the camera with the rear cover opened.

Referring to Fig. 2, the picture window of the camera 1 is formed by the rectangular opening in the frame 2 which is arranged in the focal plane of the camera objective 3. When the rear cover 4 of the camera is closed the customary pressure plate (not shown) on the rear cover 4 presses the film flat and uniformly against the frame 2. In accordance with the invention the frame 2 is provided on one of its transverse portions with a mark or sign 5 consisting for instance of a white circle or a white cross. This mark 5 may be arranged also on any other portion of the frame 2 or any other interior part of the camera casing, as long as it is covered by a portion of the rollfilm which travels from the supply spool to the take-up spool 6.

According to Fig. 1 the rear cover 4 of the camera 1 is provided with a colored window 7 through which the mark 5 is visible when the cover 4 is closed and there is no film in the camera. When a film is in the camera and extends over the picture aperture it obviously covers the mark 5. The window 7, of course, is light-proof and is suitably colored to protect the light sensitive layer on the film against exposure by light entering through the window 7.

Preferably, the window 7 is normally closed by an opaque cover plate 8 slidably mounted in a light-proof manner on the rear cover 4 and urged into closing position by a spring 10. A handle or knob 9 extends outwardly from the cover plate 8 and through a slot 11 in the cover 4, so that the cover plate 8 may be manually opened from the outside of the closed camera by moving the handle 9 against the tension of the spring 10.

HEINZ KÜPPENBENDER.
HEINRICH EYTH.
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BY A. P. C.

H. KÜPPENBENDER ET AL

ROLLFILM CAMERAS

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Fig.1.

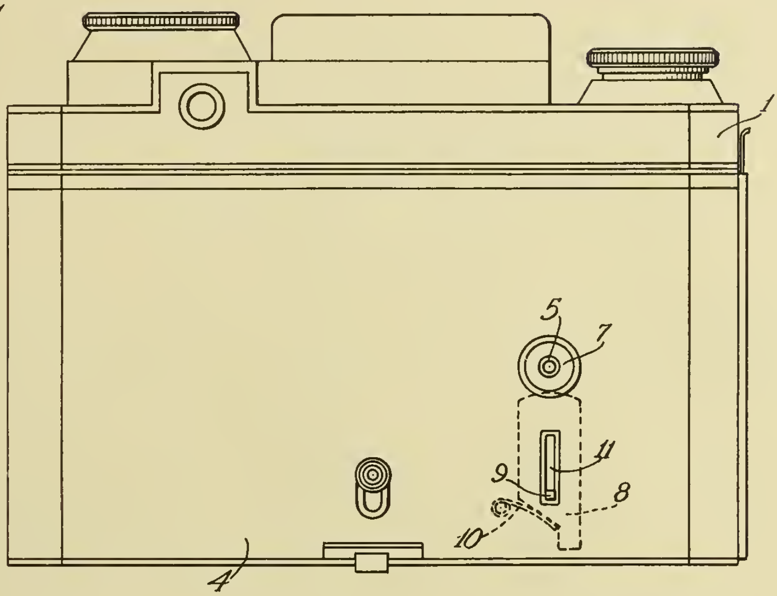
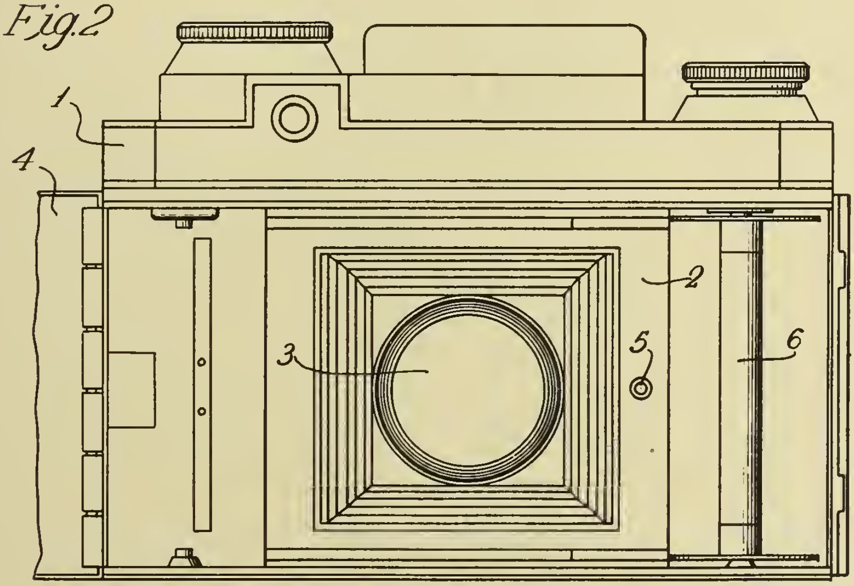


Fig.2



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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE GRANULATION OF SUPERPHOSPHATE

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No Drawing. Application filed August 9, 1939

This invention relates to an improved process for the granulation of superphosphate.

In the process according to the invention for the granulation of superphosphate, superphosphate obtained in known manner is first subjected to a mechanical treatment with simultaneous application of pressure and movement, for example by means of edge-mills, extrusion presses, pressing worms and similarly acting apparatus. The superphosphate is thus converted after a short time into the plastic condition. The superphosphate which has been plasticised in this way is then subjected to a further mechanical treatment with simultaneous application of movement and heat, by way of example in internally or externally heated rotating apparatus such as rotary tubes, mixing drums or the like. The heating can be effected directly or indirectly as desired. When employing internally heated apparatus, a temperature of between 80 and 160° C. in the interior of the apparatus is advantageous.

The superphosphate which has been converted into the plastic condition in the first stage of the process described, breaks down on treatment in the second stage into small grains of extraordinary hardness. During this conversion of the plasticised superphosphate into granular form, there is no reduction in water-soluble phosphoric acid; as a part of the moisture content of the starting material is evaporated by the heat applied in the second stage of the process, the granulated end product of the above described treatment contains a higher percentage of water-soluble phosphoric acid than the starting material.

The following example illustrates how the process of the present invention may be carried into effect:

Superphosphate was converted into the plastic condition by treatment for about 3–5 minutes in an edge-mill. The plastic mass was introduced into a rotating tube drier. The through-put amounted to 600 kgms. per hour, whilst the temperature in the tube drier was 120° C. The plastic mass thereupon broke down into extraordinarily hard, non-tacky grains. The screening analysis of the finished material gave the following results:

		cms. diameter
44%	smaller than	1
	greater than	0.5
37%	smaller than	0.5
	greater than	0.2
15%	smaller than	0.2
	greater than	0.1
4%	smaller than	0.1

The product was accordingly practically free from dust components. Analysis prior to treatment gave:

	Per cent
P_2O_5 total	18.90
P_2O_5 water-soluble	18.00

Analysis of the granulated end product gave:

	Per cent
P_2O_5 total	21.0
P_2O_5 water-soluble	19.98

The moisture content of the granulated end product amounted to 4.2%.

The extraordinary hardness of the superphosphate grains produced according to the present process may most probably be explained by a consolidation of the material. The specific weight of normal superphosphate amounts to 0.8–0.9. The specific weight of grains produced according to the present process amounts to 1.15–1.20. The consolidation is brought about by the mechanical treatment of the superphosphate which reduces the amount of hollow space which amounts to about 50% in normal superphosphate. The proportion of hollow space in superphosphate is given by the difference between its density and its specific weight. The density of normal superphosphate amounts to 2,0, the specific weight only to 0,8–0,9.

BERNHARD SCHÄTZEL.

Published May 4, 1943

Serial No. 299,888

ALIEN PROPERTY CUSTODIAN

PROCESSES OF MAKING HIGH-GRADE CELLULOSE

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No Drawing. Application October 17, 1939

This invention relates to processes of making high-grade cellulose, of which the following is a specification.

The making of cellulose from wood, straw or other vegetable matter by means of a process of disintegrating by alkali (sodium oxide, soda or sulphate process), as known, is only economical in case of a most extensive recovery of the alkali used in the process. In the sodium and sulphate cellulose factories, therefore, the alkali regeneration plant forms an essential part of the equipment. The size of a plant of this kind primarily depends upon the quantity of liquor required in the digesters, this quantity on its part depending again upon the "alkali-ratio" used in the cooking process, that is upon the quantity of alkali required for a certain weight of wood. By this "alkali-ratio" again the yield and especially the alpha-cellulose content of the manufactured product are determined, these quantities being greatly independent from other conditions prevailing during the cooking operation. The process of disintegrating the cellulose by means of alkali thus presents three main problems, to wit: to produce a cellulose as high-grade as possible, to secure a maximum yield of such cellulose and to use a most favorable "alkali-ratio" for the recovery of the alkali from the process.

In case of former cellulose materials made by means of an alkali disintegrating process, which cellulose had been used almost exclusively in the paper and pasteboard industry, a high-grade improvement process, especially with a view of increasing the alpha-cellulose content, and improving the properties of the product in a chemical way and mostly with respect to bleaching had been of no importance.

The problem of disintegrating cellulose by the alkali process in order to produce more valuable materials which at least regarding their chemical properties would be equivalent to the sulphite cellulose materials used in the manufacture of artificial silk has presented itself not before the demand of using sodium oxide or sulphate cellulose also in the wide field of chemical improvement processes, such as nitration, production of artificial fibres and the like. It had to be expected that this would necessitate a change in the "alkali-ratio." Thus, for instance, when using an alkali-ratio of 20:100 (that is 20 kg of NA_2O per 100 kg of wood, figuring also NA_2S with its equivalent NA_2O-value), it had been possible to produce materials having in unbleached condition an alpha-cellulose content of about 89%. Also it has soon been found that when increasing the alkali-ratio by one third of its value the alpha-cellulose content could be increased to from 93 to 94%. This, however, would require at the same time an enlarged equipment for the recovery of alkali which would result in conditions entirely impractical in economical respects.

A more favorable alkali-ratio could be expected when using one and the same liquor repeatedly for the several successive operations of cooking.

In order to reduce the costs of the process, the plain single-stage cooking process has been carried out with repeated use of the same liquor as a whole or in part, that is, in each new cooking process a greater or smaller amount of liquor from a previous cooking process had again been used. In other words, the material had been cooked with a liquor comprising a larger or smaller percentage of waste liquor from a preceding cooking process. Although in this way the consumption of alkali could be reduced and, what is more important, a waste liquor richer in organic substances was obtained, the material as such had not been in the least improved regarding its chemical constants.

On the other hand, plural-stage processes are known using the waste-liquor repeatedly for the cooking. Some time ago it appeared to be rather promising to use the combined cooking and diffusion process of Ungerer, according to which process the wood had been treated in digesters connected with each other to form a kind of diffusion battery at a temperature of 165 or 175° with a liquor increasing in strength from one to the next digester and finally with fresh liquor, the liquors being passed in succession through the digesters, commencing with the material which had already been rather extensively disintegrated and ending with the digester charged with fresh wood. (See German Patent No. 933 of July 13th 1877; see also C. Hoffmann, Handbuch der Papierfabrikation, 2nd edition, 1897, Vol. II, pages 1396–1399, as well as E. Hägglund, Natronzellstoff, 1926, pages 131–132. This process, however, could not compete with the less complicated cooking systems as had especially been stated in the last mentioned treatise of Hägglund, page 132, line 5.

In more recent time, G. A. Kienitz has described a similar process (see the Periodical "Holz als Roh- und Werkstoff", 1937, pages 33–35). In this case, the same as with Ungerer's process, the cooking liquor is intermittently con-

veyed from one to another digester in such a manner that the most efficiently disintegrated wood material contains the concentrated fresh liquor, while the first or initial digester, which is charged with fresh wood, is supplied with exhausted black liquor, while the second and third digester are supplied with a less exhausted liquor, until the last digester is likewise supplied with concentrated fresh liquor for the final treatment. A principal difference between the process of Kienitz and that of Ungerer consists therein that in the former process contrary to the latter the almost disintegrated cellulose is treated with the fresh liquor under very mild conditions, that is at relatively small pressure and relatively low temperature, while the fresh wood with the almost exhausted black liquor is cooked at high pressure and high temperature.

These processes, however, likewise do not represent an optimum in a technical and economical respect. This is due to the fact that these processes require rather complicated apparatus and do not at all produce a satisfactory yield. With these processes, moreover, the yield will be smaller and smaller with increasing degrees of disintegration. According to the last-mentioned inventor (l. c. 34, right hand column), the yield varies about between from 33 to 38% in case of unbleached beach-wood cellulose.

Contrary to these known processes my new process permits production of a cellulose material of exceptionally high-grade properties. In addition, very high yields of such materials, for instance, 42% bleached or 38% highly improved pine-wood cellulose and 51% bleached or 46% highly improved beach-wood cellulose may be obtained with my new process. My new process comprises an alkali disintegrating treatment performed in two stages, the raw cellulose material being treated in the first stage of the process with a cooking liquor which for its greater part is derived as waste-liquor from a preceding final cooking (that is in the second stage) and, besides, consists for its smaller part of fresh cooking liquor, so-called white liquor, while in the second stage of the process the previously cooked cellulose material is being treated with fresh cooking liquor of dimished (that is not especially increased) concentration. As compared with the heretofore known processes using waste-liquor, my new process resides principally in an essentially different distribution of alkali with respect to fresh and already treated cellulose material, the fresh cooking material being at first, that is in the first stage, treated not exclusively with an almost exhausted black liquor of low alkali concentration from the preceding cooking stage but with a cooking liquor that had been essentially improved with respect to its alkali concentration of fresh liquor, while on the other hand the alkali content of the liquor acting in the second stage onto the previously cooked material is accordingly essentially decreased.

The extraordinary favorable effect attained by this process may be based principally on the fact that the very restriction of the process to only two stages and more especially the proper distribution of alkali will have the result of preserving the structure of the fibres to a considerable degree. This is due to the fact that the fibrous material is treated in the second stage in already extensively disintegrated and consequently more sensitive condition with respect to the action of the liquor with a quantity of alkali which, although reduced, is still sufficient to produce a highly improved material, especially as the increased alkali content of the liquor permits of carrying through the disintegrating process to an appropriate extent in the first stage. The alkali in my present process is distributed approximately in such a way that in the first stage, besides the waste-liquor from the second stage of a preceding cooking (and eventual wash waters), there will be used still about from 20–30% of the total fresh liquor required for the cooking, so that the cooking in the second stage is carried through only with about from 70 to 80% of the total quantity of fresh liquor (eventually together with alkaline wash waters).

My new process, therefore, is not dependent upon an increase of the "alkali-ratio" and, consequently, in spite of the increased yield of high-grade cellulose does not require any enlarged equipment for the recovery of alkali. A further advantage of my new process consists therein that the produced cellulose materials may be bleached with extraordinary ease permitting to reduce on the one hand the consumption of chlorine and on the other hand the loss of material during the bleaching and improving process.

Example 1

57 kg of air-dry (corresponding to 50 kg of absolutely dry) pine-wood are treated in an ordinary sodium-cellulose digester, first with a liquor composed of 100 litres of waste-liquor (having an alkali content corresponding to from 20 to 25 g of Na_2O per litre) and 55 litres wash water, both originating from the second stage of a preceding cooking operation, as well as 25 litres of fresh liquor (white liquor) with an alkali content corresponding to 2.5 kg of Na_2O (that is 100 g of Na_2O per litre). Accordingly, there is a total quantity of 180 litres of cooking liquor with an alkali content corresponding to 5 kg of Na_2O.

Heating is carried through to 155° C. for about three hours. Thereupon, from 100–120 litres of black liquor are removed and the digester immediately again filled for the second stage with preferably pre-heated cooking liquor consisting of 75 litres of 10% white liquor (with respect to Na_2O), diluted with 25 litres of wash-water from the second stage of a preceding cooking. As the alkali content of the wash-water corresponds to approximately 1% Na_2O, the total cooking liquor for the second stage will be composed of the remainder of the black liquor that had not been drawn off the first cooking stage and, in addition, of 100 litres of fresh liquor including wash-water (with an alkali content corresponding to 7.750 kg of Na_2O). Thus, assuming the remainder of the liquor from the previous cooking to be 80 litres with an alkali content corresponding to 15 g of Na_2O, this cooking liquor consists in total of 180 litres of a liquor with an alkali content corresponding approximately to 5% Na_2O.

Now heat is being applied for about one hour in order to raise the temperature to 150° and the digester is kept at this temperature for about one and one half hour. Upon completed cooking about 100 litres of liquor are let off to be used for the first stage of a subsequent cooking with fresh wood. Thereupon the digester is rinsed out with about 100 litres of hot water and the contents washed in this way are discharged into a vat. The alkaline wash-water from this washing process amounts to about 80 litres and is again used in the first and second stage of the

subsequent cooking operations, as had above been mentioned. Subsequent to this, bleaching of the cellulose is carried out in known manner with chlorine water or solution of chloride of lime or the like.

The yield of bleached material amounts to 42% of the used wood, this material containing from 93 to 94% alpha-cellulose and from 4 to 5% pentosane. From this material a high-grade cellulose was obtained by means of an improvement process carried through in known manner with a liquor of caustic soda, the yield of this cellulose being about 6% higher than the yield of a material of the same chemical properties which had been improved in exactly the same way by the known single-stage process.

Example 2

In case of leaf-wood my new process will be especially efficient inasmuch as the disintegrating is carried through in a manner widely preserving the structure of the fibre and attaining an essentially greater chemical purity of the product. For instance, beach-wood can be disintegrated in the same manner as had been described in Example 1, the cooking temperature in both stages, however, may be kept from 8 to 10° lower, that is the temperature may be about 145° in both stages. Also, washing and further treatment is carried through in the same manner as according to Example 1. Thus a material is obtained containing from 93 to 95% alpha-cellulose and from 10 to 11% pentosane, the yield being about 51%. The improving process carried through in known manner with a liquor of caustic soda has resulted in the present case in a yield of high-grade cellulose about 12% higher than the yield in case of a material which had been made according to the known one-stage process and improved in exactly the same manner

Example 3

In case of straw and similar raw materials a relatively somewhat greater quantity of liquor must be applied, or what is the same, a like quantity of liquor must be used for a smaller quantity of raw material as compared with the process of disintegrating wood. On the other hand the composition of the liquor may remain unchanged in both cooking stages.

For instance, 35 kg of air-dry straw, corresponding to 50 kg of absolutely dry straw, are cooked in the first stage with 180 litres of liquor of about the same consistency as in Example 1, that is with a total alkali content corresponding to about 5 kg of Na_2O. Heat is applied for about three hours and the temperature raised to about 150° C, whereupon a quantity from 100 to 120 litres of liquor is let off and the digester immediately filled again with the liquor for the second stage, 100 litres of liquor being taken in this case with an alkali content corresponding to about 8 kg of Na_2O. Now heat is applied for about one hour to raise the temperature to 155° C, while the material is kept at this temperature for about two and one half hours. Subsequent washing and further treatment are carried out in the same manner as in case of Example 1.

In this way there is produced a yield of straw-cellulose of about 41% containing in unbleached condition about 10% wood-gum. Bleaching carried through in the usual manner has resulted in a yield of 40.5% (figured with respect to the quantity of used wood). This material contained 88% alpha-cellulose and 10% wood-gum. Upon improving with about 5% cold sodium oxide liquor a cellulose was obtained with 95% alpha-cellulose and 3% wood-gum and a yield of 37% (figured with respect to straw).

Example 4

The ratio of the quantities of liquor and cellulose raw material and the composition of the liquor are the same as had been stated in connection with Example 3.

38 kg of air-dry esparto-grass (alpha-grass), corresponding to 35 kg of absolutely dry esparto-grass, were heated together with 180 litres cooking liquor with an alkali content corresponding to about 5 kg of Na_2O for about three hours up to a tempertaure of about [illegible]5° C. After letting-off about 100 litres of black liquor the digester is immediately again filled with the liquor for the second cooking, about 100 litres of this liquor having an alkali content corresponding to about 8 kg of Na_2O being taken. Thereupon the temperature is raised for about one hour up to about 150° C and constantly kept at this value for about from two or three hours in accordance with the behavior of the raw material. Cooking, washing and further treatment of the material is thereupon carried out in the manner stated in connection with Example 1.

In this manner there is obtained a yield of cellulose of 40% comprising in unbleached condition 93% alpha-cellulose and 8% wood-gum. Upon bleaching in the usual manner with hypochlorite the material was composed of 95% alpha-cellulose and 3% wood-gum. Improving with a 5% sodium oxide liquor has resulted in a yield of 35% (figured with respect to wood) of high-grade cellulose with 99% alpha-cellulose and 1% wood-gum.

The great advantages of my new process may be seen from the below Table showing a comparison of the quantites of the bleached and improved materials with those materials which can be produced with the usual one-stage cooking and subsequent improvement processes with the same degree of disintegration and the same consumption of alkali.

TABLE

	Yield		Alpha-cellulose		Wood rubber	
	One stage process	New process	One stage process	New process	One stage process	New process
Pine-wood, bleached	40	42	89	92	8	5
Pine-wood, improved	36	38	98	98	3	2
Leaf-wood, bleached	49	51	89	94	21	10
Leaf-wood, improved	41	46	98	98	3	3
Straw, bleached	38	40, 5	82	88	17	10
Straw, improved	31	37	95	95	3	3
Esparto, bleached	38, 5	39, 5	90	96	15	3
Esparto, improved	33	36, 5	98	99	3	1

This Table shows that by my new process there may be obtained either cellulose of higher grades (that is with a greater alpha-cellulose content and smaller wood content) or in some cases higher yields of materials of the same properties.

WILHELM OVERBECK.

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ALIEN PROPERTY CUSTODIAN

CAMERAS

Heinz Küppenbender, Dresden-A. 21, Eugen Jörg, Stuttgart-S, and Hubert Nerwin, Dresden-A. 20, Germany; vested in the Alien Property Custodian

Application filed October 25, 1939

This invention relates to improvements in cameras in which electric conductors form part of the equipment. Such electric conductors may, for instance, be used in association with a photoelectric exposure meter combined with the camera, or they might be used with a flash synchronizer, or with other accessories.

It is an object of the present invention to relieve the conductors of mechanical strain and particularly to adapt the use of these conductors to cameras having bellows.

It is also an object of the invention to position the electric conductors in the interior of the camera housing in a manner to guard them against injury during the use or transportation of the camera.

Another object of the invention is to provide a camera with electric conductors associated with an expansible element of the camera in such manner that the conductors are united with the expansible element and insulated thereby with respect to other parts of the camera.

The invention also has the object of providing a camera with electric conductors associated with foldable or expansible elements of the camera and to combine the electric conductors with said elements in such manner as to eliminate thereby the conduction of current through pivot joints or through slidable contacts or to utilize loose conductors for this purpose.

Another object of the invention is to select conductors of a suitable cross-section to permit them to carry safely the current required while at the same time permitting the folding or expanding of the elements with which these conductors are associated.

The invention has the object of arranging in a camera the electrical conductors in the form of flat and highly flexible current carrying strips interposed between insulating parts of expansible elements and to envelop, if necessary, the flat flexible current conducting strips in insulating material.

The invention, furthermore, has the object of providing a camera with a flash synchronizer operable by the shutter during the release movement, and preventing accidental creation of the flash during the tensioning movement of the shutter.

The invention also has the object of providing a flash synchronizer, in which the creation of the flash is dependent upon the simultaneous closure of several contacts located remotely from each other.

Another object of the invention is to improve the association of a flash synchronizer with a camera by providing in the circuit of the electric bulb in which the flash is created, a pair of contacts, one of which is manually closable by the operator when the exposure is to be made, while the other one is closable by the shutter during its tensioning movement as well as during the release movement and to dispose these contacts serially in the circuit, whereby upon the closure of the contact under direct control of the operator, the shutter release is effected and the shutter simultaneously closes the second contact to complete the circuit.

With these and numerous other objects in view, an embodiment of the invention is illustrated in the accompanying drawing by way of example, to which reference is made in the following specification.

In the drawing:

Fig. 1 is an elevation of the camera housing showing certain parts in the interior thereof, while other parts are broken away, and shown in section;

Fig. 2 is a diagrammatic side elevation and partly section of the complete camera, and

Fig. 3 shows diagrammatically and perspectively a flexible conductor detached from the other parts of the camera.

The camera housing **1** is shown to be provided with an exposure meter **2**, the construction of which is of no importance for the present invention. This housing also is equipped with a removable rear part **3** to facilitate the insertion of film spools, not shown, and for the reception of additional elements pertaining to the present invention. A film guide plate **5** of any desired construction may be united with the rear portion of the camera. A pair of batteries **6** and **7** respectively also are removably positioned in the rear portion **3** of the camera, and as will be seen from Fig. 1, the battery **6** is seated by means of its terminal **8** in a contact socket **9** which is secured to the bottom wall of the rear portion **3** of the camera.

An insulating layer **10** is interposed between the current conducting socket **9** and the bottom wall. Similarly also, an insulating layer in the form of a disc **11** or the like is advisably interposed between the opposite terminal **12** of the camera and the top wall of the rear portion **3**.

The conductor **13** extends between the conductive socket **9** and the terminal **14** of the second battery **7**. It is obvious, however, that the two batteries **6** and **7**, instead of being positioned adjacent the two end walls of the rear portion

may also be located in other parts of the camera and may be serially connected, as indicated, or may be in other electric association, as required. The second terminal 15 of the battery 7 again makes contact with a conductive socket 16 adjacent the top wall and insulated from the metallic body 3 in some suitable way. An insulating disc 17 is interposed between the terminal 14 of the battery 7 and the metallic body of the camera portion 3.

Any other source of electric energy may be used in place of the pair of batteries illustrated as long as the source of energy is electrically insulated from the camera body.

The socket 16 is in conductive connection with a central pin 18 of a lamp socket indicated at 19, the outer sleeve of which may be grounded on the camera body, the pin 18 being insulated from the sleeve of the socket 19 by the insulating mass 20 in a way which is well known in the art. A flash bulb 21 may be removably secured within this socket 19 in a known way.

In the embodiment illustrated, the camera is shown as a camera having a bellows 22 diagrammatically illustrated in expanded condition in Fig. 2. The bellows carries at its forward end the shutter housing 23 and a lens mount 25.

The assembly of the shutter, lens mount, and adjustable diaphragm (not shown) may be carried by a rigid board, not illustrated, which also acts as a front wall for the camera housing when the camera is closed. This wall usually is hinged to the camera casing itself. These parts are well known from folding cameras and do not require either illustration or further description.

The shutter housing 23 carries a terminal plate 26 insulated from the housing and to which a resilient contact strip 27 is secured in any desired way. A highly flexible conductor 28 is secured at one end to the terminal plate 26. This conductor is formed as a strip of such cross-section that its flexibility is approximately the same as that of the expansible bellows 22 with which it is associated. The flexibility of the conductor strip 28 may be attained by braiding or otherwise uniting a great number of flexible thin conductive elements in the form of a woven or braided flat ribbon. This strip is shown positioned between two layers 40 and 41 which form a wall of the folding bellows 22, whereby these flexible walls 40 and 41 not only protect the strip 28 against mechanical injury but also insulate said conductive strip. It may be advisable, however, to envelop the conductive strip in insulating material, as indicated at 42 in Fig. 3 in the form of an insulating fabric, a coating of cellulose or the like. The elements of which the strip 28 is composed by braiding and the like may in themselves be surrounded by insulation, as for instance, by cellulose.

By locating the conductor 28 between the two layers 40, 40 of an expansible wall of the bellows 22, the conductor 28 will automatically assume the proper position as required in the expansion and folding of the bellows. No separate attachments for the conductor to the bellows are required nor is it necessary to conduct the current through slidable or pivotal joints as had been the practice heretofore.

The movable shutter element 24 is provided with a companion contact 30 adapted to engage the contact strip 27 during the movement thereof. The setting of the shutter to a selected speed effected by the adjustment of the movable element 24 must be such that the contact element 30 carried thereby will go past the companion contact element 27.

The shutter housing 23 establishes a second ground connection with the mass of the camera housing, as will be obvious from the drawing.

While one end of the flexible conductor 28 has been described as being secured to the plate 26 insulated from the shutter housing 23, the opposite end of this conductor is conductively continued to a contact carried by an insulated contact finger 32, as shown in Fig. 1.

In the embodiment shown, this finger 32 is supported by a spring 33 which rests on a support 34 in the interior of the camera. The nonconductive companion contact carrier 35 is fixedly secured to a rod 36 which forms a part of the shutter actuating means to be manipulated, as for instance, by the projecting button 37 when an exposure is to be made. The contact spring of this companion carrier 35 is connected by a flexible insulated conductor 38 with the terminal 12 of the source of current.

The electric connection between the source of current formed by the batteries 6 and 7, and the flash bulb 21 to be energized thereby therefore is closed solely when the contacts of the elements 32, 35 are connected, and when at the same time also the contact elements 27, 30 are in conductive engagement. The current then flows from the electric batteries 6 and 7 to the central contact pin 18 of the lamp socket through the bulb into the grounded part of the socket connected with the mass of the housing portion 3 and through the grounded conductor or metallic elements connecting the housing 3 with the shutter housing 23. The contact carrying plate 26 being insulated from the shutter housing, the current will flow into the conductor 28 solely upon the closure of the contacts 27, 30. This closure may occur during the tensioning movement of the shutter disc 24, but the circuit is incomplete as long as the gap between the contact carriers 32 and 35 remains open.

When the shutter has been set to the selected speed and the operator depresses the release button 37 to make the exposure, he establishes the contact between the springs on the members 32, 35, while at the same time the shutter upon being released, closes the contact between the members 27, 30, and the current flows from the plate 26 to the ground to complete the circuit.

It would also be seen that the batteries 6, 7 are arranged in the portion of the camera in such manner that they can be inserted in a predetermined position only to establish the proper serial connection between the two batteries through the conductor 13.

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Fig. 1

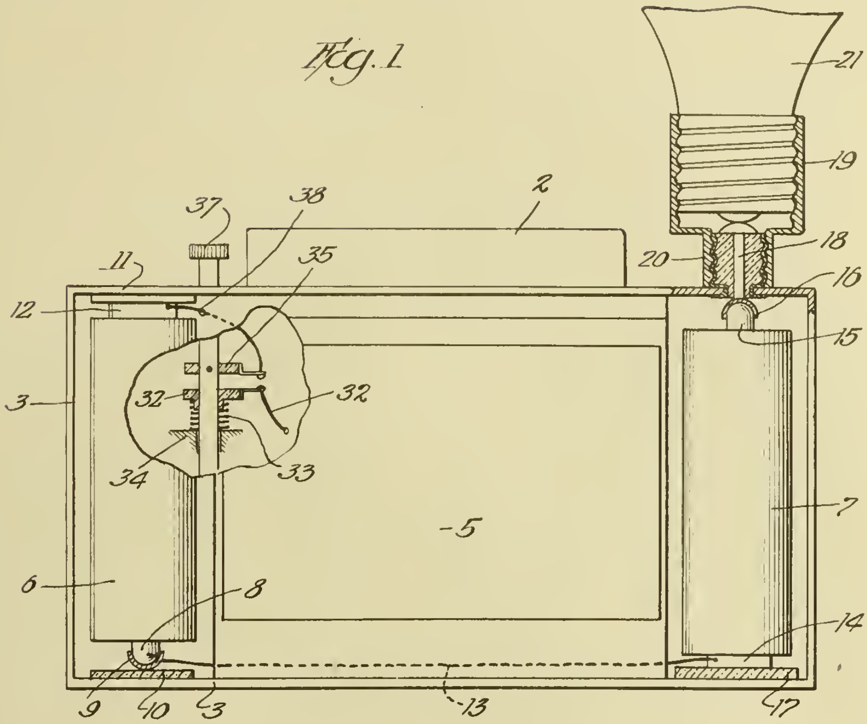
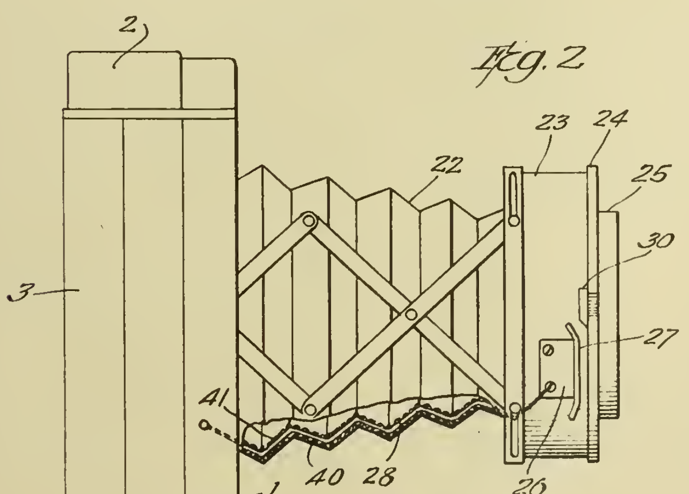


Fig. 2



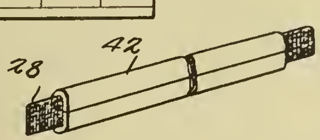


Fig. 3.

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ALIEN PROPERTY CUSTODIAN

ELECTRICAL INSULATING BODY

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Application filed October 26, 1939

My invention relates to an electrical insulating body of a titanium containing material, to electrical elements consisting of such materials and to the manufacture of the material and of said element.

It is common practice to use ceramic material containing titanium dioxide for the manufacture of insulating bodies more particularly of condensers, as titanium dioxide is characterized by a high dielectric constant. For the use of ceramic insulating bodies for high frequency purposes it is also desirable that the materials should have a low dielectric loss. Another requirement of increasing importance is that the dielectrical material should have a dielectric coefficient varying as little as possible with the change of the temperature. This is important for the production of oscillating circuits independent of the temperature. Numerous ceramic materials containing titanium dioxide have been developed for these purposes having qualities meeting the requirements of any particular use.

Sometimes certain qualities of a product of a desirable nature, for instance: independence of the dielectric coefficient of changes in temperature, must be purchased at the price of other qualities of an undesirable nature, for instance at the price of only mode dielectric constant. The object of the invention is the manufacture of electrical insulating bodies which are apt to be used as a condenser dielectric and in which the desirable properties are incorporated to an extent surpassing any limits attainable heretofore. A more particular object of my invention is the manufacture of a ceramic material comprising a densely sintered mixture of titanium dioxide and oxides of the so called three valent rare earths particularly of lanthanium oxide and/or oxides of the rare earth elements accompanying the lanthanium in the main lanthanium containing minerals. Viewed from another aspect it is an object of the invention to create a new possibility of utilizing certain vast materials which are produced in the operation on minerals of the rare earths and heretofore could not be used economically.

As above explained, ceramic dielectrics have been manufactured of materials containing titanium dioxide and having, due to the content of titanium dioxide, a dielectric constant (DC) which is large compared with other ceramic materials so that the dimensions of condensers of a given capacity made of such dielectrics could be considerably reduced. Thus materials have been produced, for instance, containing in addition to titanium dioxide substantially china clay (kaoline), soapstone or certain refractory oxides such as magnesium oxide or beryllium oxide and having a high dielectric constant. In the high frequency art, however, only a limited number of such materials containing titanium dioxide could be used, to wit such materials of this kind which have low dielectric losses. Only a very limited number of such materials were known. Of the materials containing magnesium oxide and titanium dioxide such known compounds having an extremely low loss had always a comparatively small DC. This is particularly undesirable as the DC varies but very little in such compounds with increasing content of titanium dioxide increasing for instance from 12 to 18, when the content of titanium dioxide rises from 18 per cent to 79 per cent.

I have found that compounds of this kind can be considerably improved by the admixture to the titanium dioxide of three valent rare earths, e. g. of lanthanium and its natural accompanying rare earths and of yttrium earths. The admixture to the titanium dioxide of oxides of these earths results in ceramic materials having a high DC and extremely low dielectric loss. The crude lanthanium oxide available on the market which contains

	Per cent
Lanthanium oxide	50–70
Neodymium oxide	20–40
Praseodymium oxide	3–10

and small proportions of other rare earths when added to titanium dioxide results in a ceramic material having any desirable DC of from 10 to 100 depending on the ratio of mixture and having a dielectric loss angle varying from 1 to 5 times 10^{-4}. The same result is obtained by the mixture of titanium dioxide with the crude yttrium oxide available on the market which contains 75 per cent yttrium oxide.

As lanthanium oxide and the other rare earths are a vast material obtained in the treatment of monazite sand and as it was not possible before to use this vast material for any economical purpose the present invention will materially enhance the efficiency of the process of obtaining rare earths from monazite sand.

Of particular importance for the utility of the ceramic materials manufactured from rare earths and titanium oxide and for the adaptability to various requirements arising in different cases

is the fact that the content of the rare earths in the densely sintered mixture may attain a comparatively high proportion without in any way adversely affecting the density of the sintered product, as in the case for instance with mixtures of titanium dioxide and zirconium dioxide which likewise have a high DC and a low angle of loss. In contradistinction to the mixtures containing three valent rare earths, zirconium containing mixtures will ordinarily result in a dense product and in a low angle of loss only if the content of zirconium dioxide is small and if the content of titanium dioxide is high, whereas a higher proportion of zirconium will result in difficulties if it be attempted to attain a material having a DC of 20 to 50, a low angle of loss and a high density. If the content of the zirconium oxide exceeds 16 per cent, the material will not result in a dense product but will tend to form a coarse crystalline structure of a limited strength and of a porous nature having a comparatively high angle of loss. These difficulties are not met with if three valent rare earths are used in lieu of zirconium oxide so that, in this event, materials having a DC from 20 to 50 and a low angle of loss may be produced. At the same time such properties of the mixture as are desirable for the ceramic process may be insured by the admixture of clay and/or soapstone as will be explained hereinafter by reference to specific examples.

I have mentioned hereinabove that for the materials used in the high frequency art, for instance for the provision of electrical oscillating circuits, it is often desirable that the temperature coefficient (TC) of the dielectric constant, and thereby the changes of the capacity of a condenser having a dielectric formed by the ceramic material occasioned by changes of the temperature, can be controlled within wide limits and that, if desired, the independency of the dielectric constant from the temperature may be more or less attained by a suitable choice of the constituents and the ratio of mixture of the same. This problem has led for instance to the development of a series of materials having a content of titanium dioxide so proportioned that their TC is either negative to a certain extent for the compensation of variations produced by fluctuations of the temperature of the elements of an oscillating circuit or may approach zero more or less from the positive or the negative side for producing thermal independency of the circuit element.

Let it be assumed, for example, that for such purpose the TC of an electrical insulating body shall have a value of from -100.10^{-6} to $+100.10^{-6}$. This means that the capacity of a condenser of this material shall increase or decrease not more than 100.10^{-6} when the temperature varies one centigrade. The prior ceramic material meeting this requirement have a DC from 6 to 20. This applies, for instance, to the ceramic materials available on the market under the trade name "Tempa" and "Diakond" containing titanium dioxide and applies equally to other known materials containing magnesium oxide and titanium dioxide and to materials containing beryllium oxide. Hence, it will be understood that a more or less considerable independence of temperature can be obtained only with a comparatively small dielectric constant.

Compared with this prior art my improved ceramic materials containing titanium dioxide and three valent rare earths represent a considerable improvement as a TC varying between $+100.10^{-6}$ and -100.10^{-6} is combined with a considerably higher dielectric constant such as a constant of from 35 to 42 obtainable with a mixture of titanium dioxide and lanthanium and the earths accompanying the same. Owing to the higher TC the dimensions of electrical elements produced therefrom may be considerably reduced as will be readily understood. This advantage of the titanium containing masses produced with the aid of rare earths with regard to the increased DC compared with known materials having the same TC extends far into the region of the negative TC for instance up to -500.10^{-6}, that is to say into the region in which a high DC and a somewhat higher negative TC are desired, for instance for compensating purposes in oscillating circuits. Also in this region my improved materials are superior to all other known materials containing titanium dioxide.

This superiority of my improved materials over those available on the market prior to my invention will become apparent from a consideration of the fact that the prior materials having a DC of a sufficient rate were invariably characterized by an excessive negative TC, whereas my improved materials having the same DC are characterized by a TC much more approaching the positive side or zero, respectively. Moreover, the angle of the dielectric loss of my improved materials, when used as a dielectric in an electrical high frequency field, is very low, in fact as low as such titanium dioxide containing ceramic masses only having an admixture of magnesium titanate. These known materials, however, have a comparatively limited DC. From the foregoing it will be understood that my improved condenser material is a valuable advance of the high frequency art as it results in condensers of a compact structure because of its high DC and of constant capacity under variable temperatures because of its small TC, oscillating circuits including these condensers having a high selectivity and a low loss owing to the small dielectric angle of loss. The most valuable materials are believed those having a DC of 32 to 45, particularly of from 34 to 41 and TC of from $+100.10^{-6}$ to -150.10^{-6} depending on the particular composition and manufacture and having an angle of dielectric loss of tan d of from 1.10^{-4} to 2.10^{-4}. However, those materials having a higher DC because of a small proportion of oxide of lanthanium and/or said homologues may be also serve a useful purpose because of their low angle of loss in such cases where a higher negative TC is permissible. In the manufacture of ordinary ceramic materials the cost of the raw material is negligible compared with the cost of manufacture. That is different with my improved materials as because of the finished product depends largely on the cost of said rare earths' oxides. In the manufacture of high frequency condensers, however, the use of expensive materials is economical for such purposes where superior qualities of the product are demanded. As the ceramic industry is able to produce tubular condenser bodies for instance having a thickness of but one centigrade of an inch and as the capacity of a condenser is inversely proportional to the thickness of the dielectric, the ceramic work pieces for the manufacture of condensers of a high capacity are small and have a limited weight and, therefore, can be manufactured at a low cost in mass production. In the high frequency industry, a dielectric material

characterized by a slightly negative or slightly positive TC is urgently needed, as there is an increasing demand for compensated condensers and oscillating circuits adjusted for a predetermined dependency on the temperature.

My invention is also applicable to larger condensers of an extremely high capacity having the shape of plates, cups, flanged cylinders, receptacles or the like, as in these cases the use of a substantially more expensive material than used heretofore may be quite economical, for instance because the higher DC of my improved materials compared with that of magnesium silicate materials having a DC of 6,5 renders it possible to substitute a single plate of my improved material having a DC of about 40 for 6 plates of the prior steatite materials. In many cases the saving in space amounts to a substantial advantage justifying a higher cost of the material.

It is an important fact that a comparatively inexpensive lanthanium oxide of limited purity is available on the market for the present purpose. This material contains

	Per cent
Nd_2O_3	26 to 30
Pr_2O_3	5,5

whereas a lanthanium oxide having a purity of 90 per cent would be less useful as it is less durable. A high proportion of cerium oxide in the material is detrimental.

I may state that, particularly for the purpose of making a dielectric having a DC substantially independent of changes in temperature, the use of lanthanium oxide results in a durable material only if neodymium and praseodymium are present at the same time in the above stated proportions. Pure or substantially purer lanthanium oxide is unsuitable because it is more expensive to produce and because it is not durable. Lanthanium oxide in itself results in durable bodies only if other oxides reducing the dielectric constant, such as magnesium oxide and beryllium oxide, are present in sufficient proportions.

Similar considerations apply to the use of the pure lanthanium-homologues, for instance of neodymium oxide. The use of these materials is impractical compared with the use of lanthanium oxide not separated from its accompanying earths, since these other pure oxides are not sufficient available on the market and are so expensive as to preclude an economic use thereof.

The durability of the new product particularly under the influence of water, has been extensively tested and found to be satisfactory. This applies particularly to materials containing less than 75 per cent of an oxide marketed in Germany by the Auer-Gesellschaft, Oranienburg, under the trade name "Lanthanoxyd I." The chemical, mechanical and dielectric properties of the material justify the conclusion that the sintered material contains probably at least two compounds to wit $3La_2O_3.2TiO_2$ and $La_2O_3.4TiO_2$ and mixed crystals of these two compounds.

To the ceramic material I may add clay, MgO, BeO and/or ZrO_2 and have found that these additions have satisfactory results, particularly with materials having a DC of from 20 to 45. The addition of these materials facilitates the manufacture and is apt to reduce straying of the TC and DC and to enhance the chemical durability of the material. Straying of the above values has been observed in my improved materials as well as in the prior condenser materials. The materials containing these additions have a quite satisfactory angle of loss and a TC which is more negative or less positive than in the absence of these additions.

Hereinafter I shall disclose a number of materials manufactured in accordance with my invention stating their composition, the process of their manufacture and their properties. The properties of the most important materials containing commercial lanthanium oxide including didynium (neodymium and praseodymium) oxide, will appear from the enclosed drawing in which Fig. 1 is a diagram illustrating the relationship existing between the dielectric coefficient of the lanthanium material from the proportion of titanium dioxide thereof, while Fig. 2 illustrates the relationship of the temperature coefficient of these materials from their dielectric coefficient.

The diagram of Fig. 1 applies to materials containing in addition to titanium dioxide either the material known on the market as "Lanthanoxyd I" having the following composition:

	Per cent
La_2O_3	64 to 68.50
CeO_2	0.47
Nd_2O_3	26 to 30.
Pr_2O_3	5.50

or the material available on the German market under the name "Lanthanoxyd roh" containing 8–12 parts cerium oxide per 100 parts lanthanium oxide, or "Ceritoxyd" containing about 40 parts lanthanium oxide and accompanying earths per 60 parts cerium oxide, or didymium oxide.

For a given proportion of titanium dioxide, the materials containing yttrium oxide referred to in the examples recited hereinbelow have a higher DC than the materials represented by the diagram of Fig. 1. I prefer for the manufacture of these materials to use a commercial product containing 75 per cent yttrium oxide. This product is superior to one containing 85 to 95 per cent yttrium oxide. Less favorable values than those of the diagram of Fig. 1 will be obtained with a product available on the German market as "Lanthanoxyd II". This product contains the smallest traces of CeO_2, of Nd_2O_3 and Pr_2O_3 and contains 90 per cent La_2O_3.

Fig. 2 is a diagram illustrating the temperature coefficients of the DC values of the materials dealt with in Fig. 1. At the same time Fig. 2 includes a diagram showing the corresponding data of some other known titanium dioxide containing materials such as the materials having an admixture of beryllium oxide, zirconium oxide and magnesium oxide. Also the data of some other commercial materials (except magnesium titanates) are shown, including the materials available on the market under the trade names "Condensa F—C—N", "Kerafar R—S—T—U—V" and "Tempa N".

The above described new properties of my improved ceramic material containing titanium dioxide and lanthanium oxide render my invention particularly applicable to condensers and oscillating circuits including the same in which the capacity shall be either constant with fluctuation of the temperature or shall vary with such fluctuations in the opposite sense thereof within wide limits. The electrical data of a circuit containing a condenser having a positive TC may be rendered constant by inclusion in the circuit of one or more condensers made of my improved

ceramic material having a negative dielectric DC. By suitably combining condensers of the improved type having a negative TC with condensers having a positive TC, any desired resultant TC of the entire arrangement may be obtained. This resultant TC may be made negative if that is necessary for compensating a positive TC of other circuit elements such as inductance coils. Thus obtaining a circuit having a constant frequency independent of variations of the temperature.

My invention is of particular importance for the manufacture of condensers having a negligible TC of from $+150.10^{-6}$ to -150.10^{-6}. Condensers of this kind having a ceramic dielectric are not novel but the known dielectrics of this kind had invariably a comparatively low dielectric constant of from 6 to 18. The present invention has made it possible for the first time to secure a DC exceeding 18 combined with an extremely small TC, the DC attaining considerable amounts of from 20 to 45. This is extremely favorable because it permits the dimensions of condensers for high frequency purposes, particularly short wave purposes, to be considerably reduced.

The technical advance attained by my improved materials is clearly illustrated by a comparison with the known titanate materials having a similarly low angle of loss. These materials have a much smaller DC. Moreover, it is possible within very narrow limits only to arbitrarily render the DC negative or positive as desired, as a functional connection consists between the DC and the TC. My improved materials, however, may be so produced that by electing a suitable proportion of the components of the mixture, the TC may be rendered more or less negative or slightly positive as desired. This applies to materials having a DC varying between wide limits, the materials having a low dielectric loss.

The process of manufacture is the following: The components are mixed and then ground in wet condition from 25 to 30 hours within a rotary ball drum of porcelain, the balls consisting of flint. The mixture is then dried and moulded in the manner customary in the ceramic industry, for instance by the customary dry pressing process. The bodies so produced are then burned in the customary manner at a temperature of Seger Cone (SC) 10 to 15. The period of time within which the final temperature should be reached, may be different depending on the bodies to be produced. With bodies of small dimensions the temperature may be raised to the final limit within 1 to 10 hours. With bodies of larger dimensions, however, this period is preferably chosen from 20 to 25 hours. The final temperature is maintained from 1 to 5 hours, the exact burning time being determined in each case by simple experiment as usual in the ceramic art. After the bodies have been allowed to cool, the opposite faces thereof are—in a manner known per se—coated with a liquid rare metal compound, for instance burnishing silver and are subjected to a burning temperature of from 500 to 800 centigrades. In this operation firmly adhering coatings of metal are formed. The condensers so produced are particularly adapted for use in electrical oscillating circuits.

I shall now set forth a number of examples for my improved materials. In referring to "Lanthanoxyd I" or "Lanthanoxyd II" I mean the materials having the composition described hereinabove:

(1)

Lanthanoxyd II	18 per cent
Titanium dioxide	82 per cent
	100 per cent
Burning temperature	SC 14 collapsed to SC 14 bent
Dielectric constant	67
Angle of loss	tan $d=2.10^{-4}$
Temperature coefficient	$TC=-590.10^{-6}$

(2)

Lanthanoxyd I	16.6 per cent
Titanium dioxide	83.4 per cent
	100 per cent
Burning temperature	SC 13 collapsed to SC 14 bent
Dielectric constant	82
Angle of loss	tan $d=9.10^{-4}$
Temperature coefficient.	$TC=-815.10^{-6}$

(3)

Lanthanoxyd I	41.3 per cent
Titanium dioxide	58.7 per cent
	100 per cent
Burning temperature	SC 13 collapsed to SC 14 bent
Dielectric constant	45
Angle of loss	tan $d=2.10^{-4}$
Temperature coefficient.	$TC=-275.10^{-6}$

(4)

Lanthanoxyd I	62.2 per cent
Titanium dioxide	37.8 per cent
	100 per cent
Burning temperature	SC 13 collapsed to SC 14 bent
Dielectric constant	40
Angle of loss	tan $d=1-2.10^{-4}$
Temperature coefficient.	$TC=0$ to -50.10^{-6}

(5)

Lanthanoxydhydrat I	55 per cent
Bentonite	2 per cent
Titanium oxide	43 per cent
	100 per cent
Dielectric constant	32–36
Temperature coefficient	$TC=-110-$ -160.10^{-6}
Angle of loss	tan $d=1-2.5.10^{-4}$

(6)

Lanthanoxydhydrat I	40 per cent
Wildsteiner Blauton	3 per cent
Bentonite	2 per cent
Titanium oxide	40 per cent
Magnesite	15 per cent
	100 per cent
Dielectric constant	25–26
Temperature coefficient	$TC=+24-$ $+54.10^{-6}$
Angle of loss	tan $d=3.5-7.5.10^{-4}$

(7)

Yttrium oxide of 75 per cent content	54.6 per cent
Titanium dioxide	45.4 per cent
	100 per cent
Burning temperature	SC 14I
Dielectric constant	64–70
Angle of loss	tan $d=3.5-5.5.10^{-4}$
Temperature coefficient	$TC=-600.10^{-6}$

(8) Yttrium oxide of 75 per cent content ------ 44.6 per cent
Titanium dioxide ------- 55.4 per cent

100 per cent

Burning temperature	SC13–14
Dielectric constant	71–75
Angle of loss	tan d=9–12.10^{-4}

(9) Didymium oxide -------- 51.8 per cent
Titanium dioxide ------- 48.2 per cent

100 per cent

Burning temperature	SC 13–14
Dielectric constant	36–41
Angle of loss	tan d=3–4.10^{-4}
Temperature coefficient	TC=−20.10^{-6}

As stated heretofore, the lanthanium oxide is preferably used together with the natural accompanying earths containing in the Cerite- and monazite minerals, for instance in form of the raw or commercially pure lanthanium oxide having 60 to 90 per cent La_2O_3 obtained when monazite sand is worked up. The titanium dioxide must be a product free from alkali and iron in order to obtain a low loss of angle. It may be pure rutile or a material produced by precipitation from a watery solution available on the German market under the name "Titanweiss".

I may add suitable fluxes and plastifying media as known for ceramic low-loss materials containing titanium dioxide. The proportion of these additions must be found by tests.

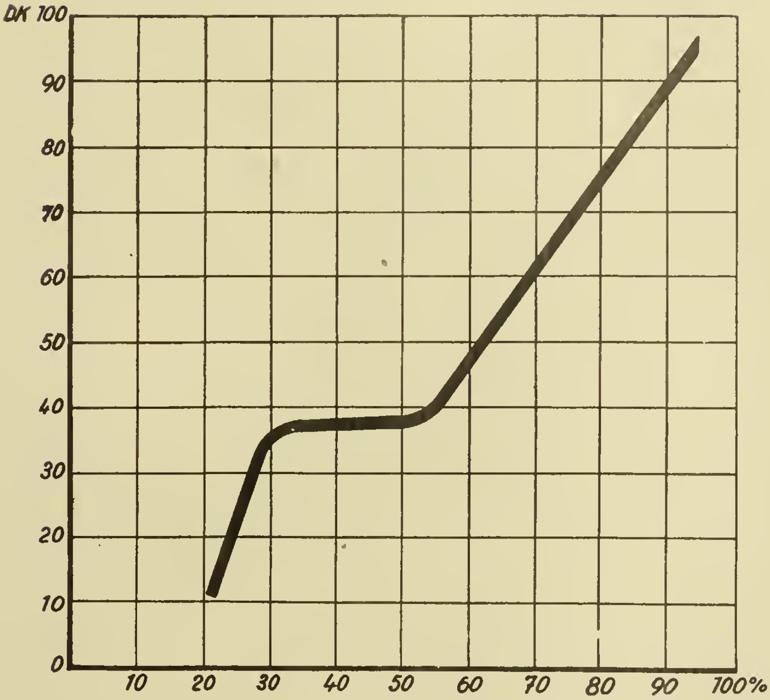
The data following hereinafter will clearly illustrate the superiority of my improved materials. These data give the dielectric constants of such materials which have dielectric properties independent of temperature, i. e. TC=0 and the dielectric constants of such materials where the temperature coefficient is small but negative.

	Dielectric constant for—	
	TC=0	TC=−100.10^{-6}
BeO—TiO_2—materials	DC=10–11	14–15
ZrO_2—TiO_2—materials	13–15	18–21
Known materials of the commerce	10–11	18–20
La_2O_3—TiO_2—materials	34–41	36–41

WERNER RATH.

PUBLISHED	W. RATH	Serial No.
MAY 11, 1943.	ELECTRICAL INSULATING BODY	301,323
BY A. P. C.	Filed Oct. 26, 1939	2 Sheets-Sheet 1

Fig. 1



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Attorney

PUBLISHED

MAY 11, 1943.

BY A. P. C.

W. RATH

ELECTRICAL INSULATING BODY

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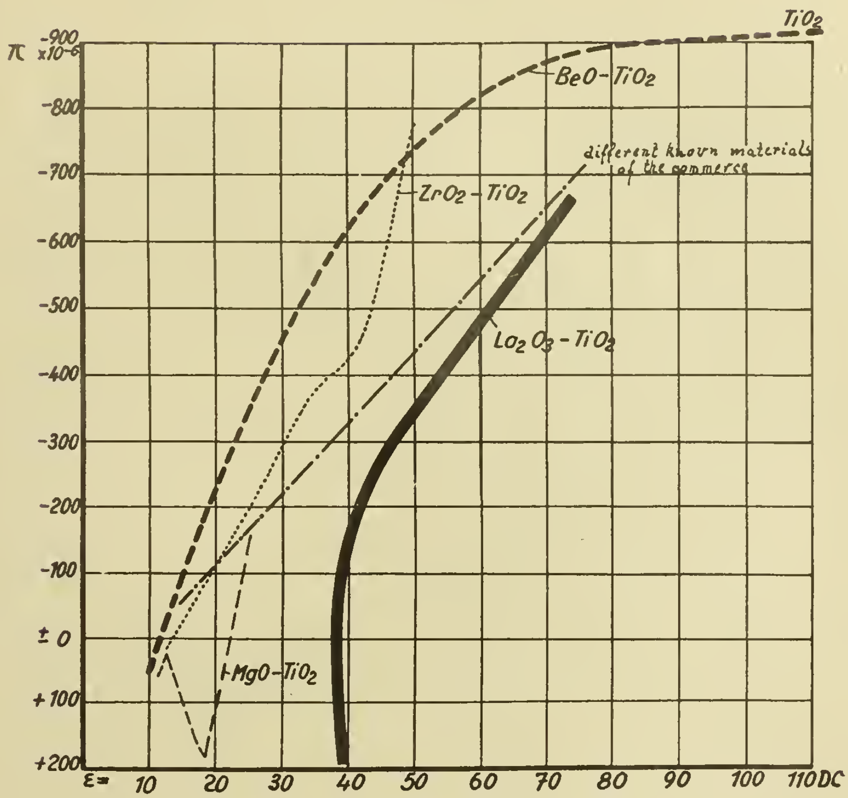
2 Sheets-Sheet 2

Fig. 2



Inventor

WERNER RATH

By

Attorney

Published May 11, 1943

Serial No. 302,585

ALIEN PROPERTY CUSTODIAN

DOSING ARRANGEMENTS

Michiel Johannes Stoel Feuerstein, The Hague, Netherlands; vested in the Alien Property Custodian

Application filed November 2, 1939

This invention relates to dosing arrangements for adding to a main medium, flowing through an open or closed conduit, a quantity of another medium controlled in predetermined relationship to the volume of the main medium. Such arrangements may be employed, for example, for dosing drinking water systems, e. g. by the addition of substances, such for example as potassium permanganate or potassium iodide, or for softening boiler water by the addition of other substances to the feed water. There are, however, in the art many other cases where such dosing arrangements are useful.

It has already been proposed continually to supply the medium to be added by a pump and to vary the quantity of added medium in accordance with the quantity of flow of the main medium by varying the output of the pump by speed regulation of its driving motor. Such arrangements, however, are liable to be complicated in construction and are not always trouble-free in operation.

According to the invention a control member operated in accordance with the volume of the main medium flowing per unit of time acts on a servo motor comprising a follower which adjusts the ratio of a transmission gear between a feed device for the added medium and the driving device therefor, the feed device being such that its output is proportional to the driving speed.

Such arrangement, whilst being simple in construction and operation, gives reliable and accurate mechanical regulation over a wide range.

Two practical examples of the invention are shown in the accompanying drawings, in which

Figure 1 shows one arrangement including variable transmission gear of the belt type, and

Figure 2 shows a similar arrangement but employing friction wheel gear instead of belt driven gear.

In Figure 1 the main medium, e. g., drinking water, flows through a conduit 1. for example in the direction of the arrow 2. The conduit 1 is furnished with a throat 3 such as a measuring nozzle, throttle or the like connected at two points of different flow velocity, respectively through two branch pipes 4 5 with a Venturi meter 6 which is provided with a rotary indicator 7 for indicating the quanttiy of flow per second through the pipe 1. The indicator 7, or a member connected thereto, carries a brush contact or contacts 8, which pass over contact strips 9, 10, arranged on a support 11 which can turn coaxially with the indicator 7 and is provided with a worm with which a worm wheel 12 engages. The worm wheel 12 is driven by a reversible motor 13 supplied with power from mains 14, 15 through a conductor 16, the indicator 7, contacts 8 and thence either through the contact strip 9 or 10 and the conductor 17 or 18, according to whether the contact 8 bears on the contact strip 9 or 10. The circuit is completed by a conductor 19. The motor 13 thus operates in the one or the other direction according to whether the contact 8 bears on the strip 9 or 10, whereby the operation is such that the support 11 is so turned that the brush 8 always returns to rest between the contact strips 9 and 10, the power supply to the motor 13 being thus cut off so that it comes to a standstill.

The mechanism just described is a real servomotor with follower device.

In addition to the worm 12 the motor 13 drives a screwed spindle 20 engaged by a travelling nut 21 carried by a bar 22. Thus, when the motor 13 operates it moves the travelling nut 21 to the left or to the right the motor thus shifting, through the fork 23, a belt 24, which passes round two conical pulleys 25 and 26.

The pulley 25 is driven from a motor 27 which is separately supplied with power from the mains 14, 15. Thus, when the motor 27 is running at constant speed, the pulley 26 will be driven at a speed in accordance with the position of the nut 21 and thus according to the position of the indicator 7 of the Venturi meter 6.

The pulley 26 drives a piston pump 30, though it will be understood that any other suitable form of displacement pump, e. g. a plunger pump may be used provided that it has a feed output which is proportional to the speed of the driving shaft. The pump draws the medium to be added from the reservoir 31, and supplies this medium through a pipe 32 into the stream of the main medium flowing in the pipe 1, the quantity of added medium being proportional to the position of the indicator 7 of the Venturi meter and therefore to the flow per second of the main medium through the pipe 1.

The belt transmission gearing shown may be replaced by variable transmission gearing of other construction. For example, each of the pulleys 25 and 26 may be replaced by two conical pulleys whose vertices are directed towards each other and which are adjusted axially away from or towards each other, the belt being provided with wooden blocks. As the two conical pulleys approach each other, so the belt contacts with a larger diameter, and as they move farther from

each other so the belt contacts with a smaller diameter. Such gear is known as "Flender" or "Reeves" gear.

The arrangement shown in Figure 2 includes, as in Figure 1, a meter **6** with indicator **7**, contacts **8**, contact strips **9** and **10** on a support **11** driven by a worm **12**, the motor **13**, the screwed spindle **20** and the driving motor **27**. The latter, however, drives a gear wheel pump **35** through a friction wheel drive comprising a roller **37** movable along but not rotatable on a shaft **36** and driving a disc **38**. The connection between the disc **38** and the pump **35** is effected through bevel wheel gear **39**. The roller **37** is moved to and fro by a fork **40** which is carried on the spindle **20** by the travelling nut **21**, the roller **37** taking up a position proportional to the position of the indicator **7**. As a result, the pump **35** operates at a speed proportional to the quantity of flow per second of the main medium through the pipe **1**. The added medium is again drawn from the reservoir **31** and delivered through the pipe **32** to the pipe **1**.

Any other suitable form of variable ratio friction drive may be employed, there being a large number of such types of gear. The main object of the invention is, however, to regulate the device for supplying the added medium by regulation of the transmission ratio of the gear between the said supply device and the driving device therefor, particularly by the use of a servo motor control.

MICHIEL JOHANNES STOEL FEUERSTEIN.

PUBLISHED
MAY 11, 1943.
BY A. P. C.

M. J. STOEL FEUERSTEIN
DOSING ARRANGEMENTS
Filed Nov. 2, 1939

Serial No.
302,585

FIG. 1

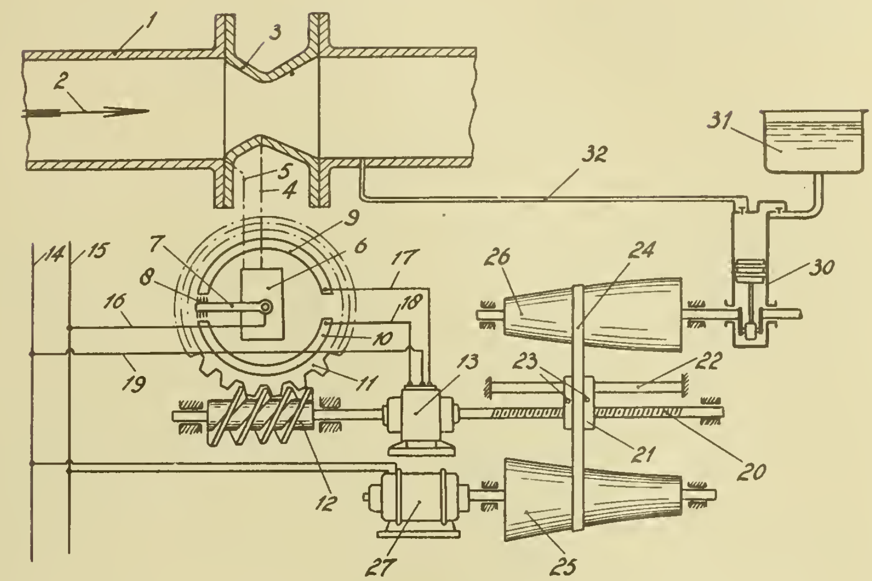
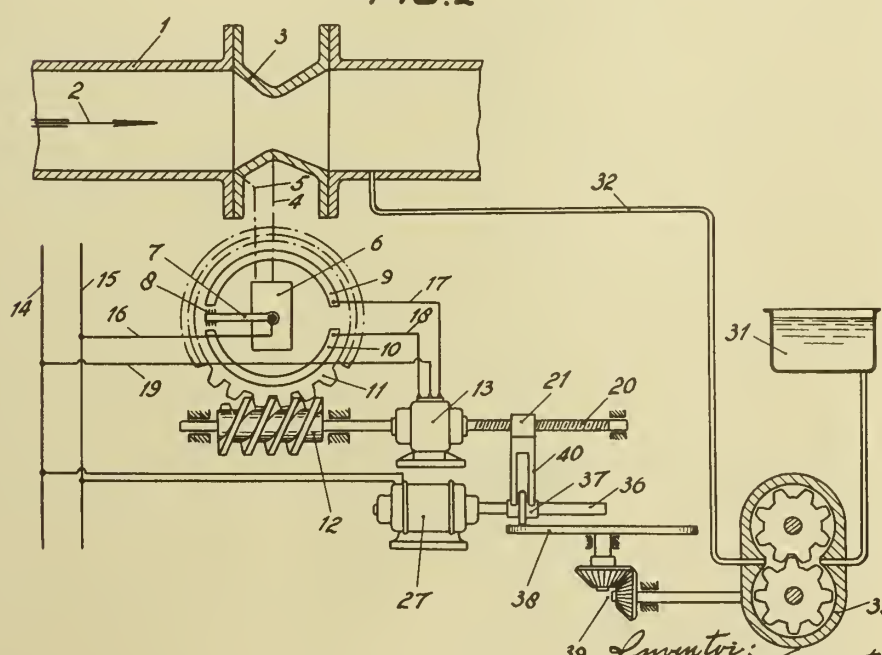


FIG. 2



Inventor:
M. J. Stoel Feuerstein
By E. F. Wenderoth Atty

Published May 4, 1943 Serial No. 302,919

ALIEN PROPERTY CUSTODIAN

SCREEN FOR PAPER STOCK AND THE LIKE

Otto Imset, Skoyen, near Oslo, Norway; vested in the Alien Property Custodian

Application filed November 4, 1939

The present invention relates to screens for paper stock, wood pulp and the like. Such screens are usually provided with means for automatic cleaning of the screen apertures. The method most frequently used consists substantially in generating pulsatory increases of pressure in the suspension on the discharge side of the screen, which increases of pressure have the effect that the suspension with short periodical intervals is driven back through the screen apertures. The pulsatory increases of pressure are usually generated by means of vibrating members disposed on the discharge side of the screen, or by oscillating the screen plates themselves.

The main object of the invention is to provide an improved method of operating screens of the kind described, by means of which method a better cleaning of the screen holes may be obtained.

The invention comprises further means for carrying out the method according to the invention.

In the following the invention will be described as applied to a screen of the plane type; it will, however, be understood that the invention with advantage may be used for screens of other types too, for instance for rotatable screens.

In screens of the plane type, the pulsatory increases of pressure are usually generated by means of oscillating diaphragms disposed below the screen plates and enclosing a chamber between the screen plate and the diaphragm. The diaphragms are usually operated from excentrics or cams. If a compulsory driving of the diaphragms by means of excentrics is used, the pressure in the said chambers will vary substantially according to a sinus function. A complete working period consists of a screening period and a cleaning period. The screening period occurs when the diaphragm is moved downwardly, the stock being sucked from the upper side of the screen plates through the slitlike apertures and down into the diaphragm chamber. During the cleaning period the diaphragm is moved upwardly and forces a minor part of the stock from the diaphragm chamber and back through the screen apertures.

The cleaning effect depends substantially on the relative difference between the maximum underpressure during the screening period and the maximum overpressure during the cleaning period. During free running of the screen, that is when the static altitude of fall is like zero and the liquid level in the discharge box is at the same height as the liquid level above the screen, the pressures during the screening and cleaning period will be of equal heights, but in the first case positive and in the second case negative. With increasing capacity of the screen the static altitude of fall must be increased, i. e. the liquid level in the discharge box must be lowered, with the result that the maximum pressure during the cleaning period will decrease and the maximum pressure during the screening period correspondingly increase. Thus the effectivity of the cleaning period will decrease as the static altitude of fall increases. According to the methods hitherto known for operating screens of this kind every working period is identical with the subsequent working period.

According to the present invention the mean pressure in the chambers between the screen plates and the diaphragms is automatically raised to a pressure beyond the mean pressure which prevails in the said space when the outlet from the same is closed, the period during which the mean pressure in the said space is raised being short in relation to the interval between two such periods.

The invention will now be described with reference to the accompanying drawing in which:

Fig. 1 shows a diagram illustrating the pressure variations in the stock below the screen plates in a screen operated according to the invention,

Fig. 2 diagrammatically shows a plan view of a screen plant provided with means for carrying out the method according to the invention. and

Fig. 3 is a section along the line III—III on Fig. 2, on a somewhat enlarged scale.

On Fig. 1 **0—0** designates the zero-line during operation and **0′—0′** the zero line during free running. The wave line indicates the pressure in the suspension on the discharge side of the screen plates. The course of this curve between the lines A—B corresponds to the usual operation of a plane screen. The hatched parts R_s and S_s represent the cleaning and screening period respectively.

The new feature according to the present invention consists therein that the frequent pressure variations are superposed by a periodical pressure increase, being on Fig. 1 represented by the section B—C. The period of time corresponding to this section is in the following description designated by "the large cleaning period" and the period A—B by "the large screening period." The hatched parts R_r and S_r represent respectively the cleaning and the screening periods in the "large cleaning period" corresponding to the parts R_s and S_s in the "large screening period." The increase of pressure dur-

ing the "large cleaning period" may conveniently be chosen so that the suction action (S_r) in this period forms only a fraction of the suction action (S_s) in the "large screening period." A large screening period and a large cleaning period together constitute a large working period. The large cleaning period is according to the invention given a comparatively short duration in proportion to the large working period, the ratio being preferably made to lie between $^1/_{10}$ and $^1/_{100}$.

In order thoroughly to understand the arrangement of this diagram it is necessary to have a knowledge of certain properties of the pulp-suspension that is to be graded. Taking for example a mass of cellulose with a concentration of, say, 5 per cent, it can be observed that the separate particles of fibre combine together in tangled clumps, provided the pulp is allowed to flow quietly enough. In consequence of this combination the fibres will therefore be unevenly distributed in the water. When these clumps of fibres come to be sucked through a narrow slot there will first take place a partial expression of water from the clump and when the underpressure beneath the screen plates becomes sufficiently great the whole clump will be sucked through the slot. Meanwhile it may sometimes happen that such a clump comes to lie over the slot at the close of the suction period and that the suction pressure is not strong enough to draw it through the opening. The result will be that at the place in question there will lie a layer of fibres largely deprived of water, which layer will choke up the openings and prevent further passage of the pulp. The short cleaning period is fully sufficient to raise the layer of fibres from the plates and free the apertures from stoppages of this kind, so that the pulp can once more flow through. Meanwhile there are other kinds of impurities which may cause the slot apertures to become closed again. Among these may be mentioned solid particles of such shape and dimensions that they are able to wedge themselves firmly into the apertures. Deposits of resin are also common, and clumps of fibres which originally lay quite loose in the apertures will in course of time become "packed in" according as the deposition of resin increases. Against impurities of this kind there is needed quite a different and more vigorous process of cleaning than what takes place in the so-called "large screening period." From the above it will be understood that the arrangement shown in the new diagram of operation affords means of attaining a better cleaning of the screen plates and of thereby maintaining the capacity.

The working diagram shown applies to a single screen plate. Usually a level screen comprises several, for example 12, such plates and the time of beginning the large cleaning period may advantageously be arranged in such a manner that only one of the 12 plates is cleaned at a time. In this way $1/12$th of the screen will in reality be rendered unproductive, but this reduction in effectivity of the screen will be abundantly compensated for by a considerably increased capacity of the plates that are functioning. It is a well-known fact that newly cleaned screen plates have a considerably higher capacity than plates which have been operating for, say, a couple of hours. The large cleaning period should in reality correspond to the washing with jets of water or steam from the upper side of the screen plates, which method of cleaning is employed at certain intervals. The difference is, however, that by the new system the dirt in the slots is driven back to the upper surface of the plates, whereby pollution of the pulp is avoided. Moreover, the large cleaning period according to the new diagram sets in more frequently, so that depositions of resin should not make themselves felt so much as was formerly the case. On washing the plates from their upper surface all dirt removed from the slots is driven down into the diaphragm chamber and thus pollutes the pulp. As the washing often takes place while the screen is in operation it may also happen that particles of dirt floating in the pulp are forced through the apertures, whereby the pulp is still further polluted.

In order to attain the automatic periodical increase in pressure there may advantageously be arranged in connection with the chambers on the discharge side of the plates pipes for periodical conveyance of liquid under pressure to the said chambers.

In Figs. 1 and 2 is schematically shown a suitable form of execution for appliances for the utilisation of the invention. In this form of execution the aforesaid pipes are connected with ejectors discharging into channels running transversely under the diaphragm chambers and leading from each chamber to a discharge box or channel common for all the chambers.

In Figs. 2 and 3 the figure **1** indicates a screen trough in which are placed 6 screen plates **2**. Under the plates are placed ordinary diaphragms **3**, which by means of a mechanism, not shown, are kept in oscillating movement in order to bring about a pulsatory pressure in the diaphragm chambers **4**. From these chambers the pulp passes through a channel **5** running transversely under each chamber, which channels discharge into a common discharge box **6**.

The apparatus according to the invention comprises a water supply pipe **7**, working in connection with each diaphragm chamber, which pipe in the form shown on the drawing is constructed as an ejector, and which discharges into the channels **5**. By letting the ejector discharge into the transversely placed channels **5** it is ensured that the conversion of the kinetic energy of the liquid to pressure energy will take place with the greatest effectivity.

The liquid is conveyed under pressure to the ejectors from a common supply channel **8**. The opening and closing of the separate ejectors is effected by means of a valve introduced before each ejector, which valves are controlled automatically from a control device acting in common for all of them. In the form of execution shown on the drawing these valves are constructed in the form of a diaphragm **9**, for example of rubber, outside of which there is a chamber **10** which by a pipe **11** is connected with a control device **12** common for all the ejectors. The valves operate in the manner that, when liquid is not to be conveyed to them, i. e. in the "large screening period", pressure is maintained against the inlet ends of the injectors by keeping the chamber **10** under pressure. When the injectors are to be brought into action, i. e. during the "large cleaning period", the pressure in the chamber **10** is diminished and the liquid under pressure flows from the channel **8** through the injector and into the channel **5**.

The control apparatus **12** may be executed in any suitable and known manner, for example by use of a rotating member which by successive

movements brings the pipe 11 into connection with a chamber in which the pressure is low, while the pipes otherwise are in constant communication with a chamber in which high pressure prevails.

As pressure liquid for the ejectors may be used water or, for instance, the pulp in suspension.

Any more detailed description of working of the apparatus will presumably be unnecessary, as it will at once be understood by experts on reference to the above account of the mode of procedure in accordance with the invention.

OTTO IMSET.

PUBLISHED | O. IMSET | Serial No.
MAY 4, 1943. | SCREEN FOR PAPER STOCK AND THE LIKE | 302,919
BY A. P. C. | Filed Nov. 4, 1939 |

Fig. 1.

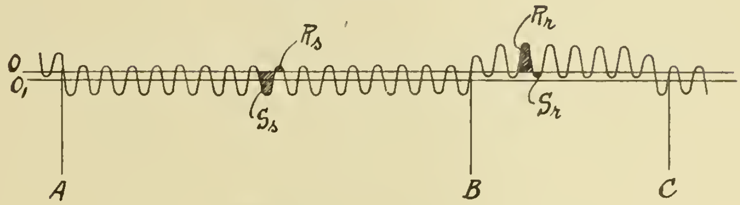


Fig. 2.

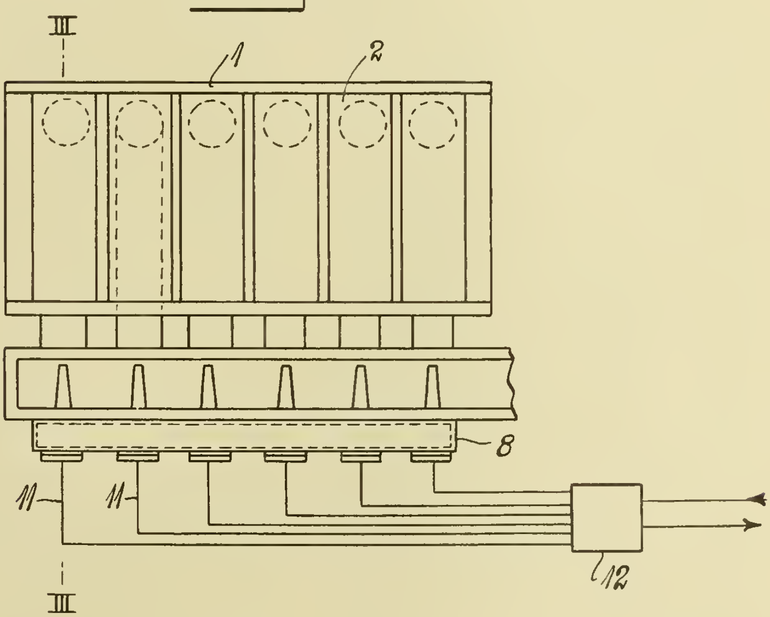
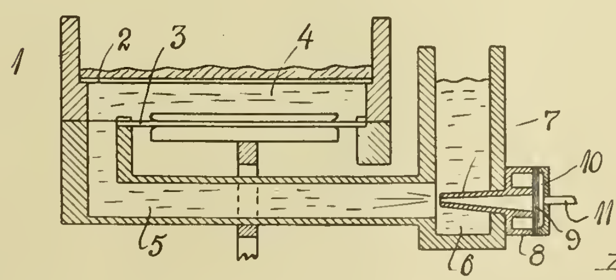


Fig. 3.



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By: Glascock Downing & Seebold
Attys.

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ALIEN PROPERTY CUSTODIAN

MAGNESIUM ALLOYS

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No Drawing. Application filed November 9, 1939

Our invention relates to multiple-substance alloys of magnesium and has for its object to produce magnesium alloys of the kind described that are better able to fulfill up-to-date requirements with respect to the mechanical properties of magnesium alloys than the magnesium alloys that were known heretofore.

Our invention substantially resides in that 0.5 to 8% bismuth and 0.2 to 4% titanium are added to magnesium alloys, irrespective of their composition in other respects. In this manner we obtain magnesium alloys having tensile strengths of 33 to 35 kg per squ. mm, 17 to 24% elongation and 30 to 35% reduction of area.

An alloy according to our invention, consequently, contains 0.5 to 8% bismuth and 0.2 to 4% titanium, and the remainder consists of magnesium and any suitable alloying elements.

A magnesium alloy containing 6% aluminium, 1% zinc, 0.3% manganese, remainder magnesium, has, in extruded condition, a tensile strength of 29 to 32 kg per squ. mm and 12 to 8% elongation.

By adding to this alloy 3% bismuth and 0.5% titanium, its tensile strength is raised to 32 to 34 kg per squ. mm, and its elongation to 17 to 18%.

By adding to the first-mentioned alloy 5% bismuth and 2% titanium, its tensile strength becomes 33 to 34 kg per squ. mm, and its elongation is again 17 to 18%.

An alloy containing 6% aluminium, 3% zinc, 2% cadmium, 0.5% manganese, remainder magnesium, has, in forged condition, a tensile strength of about 29 to 32 kg per squ. mm, and 12 to 8% elongation.

By adding to this alloy, in conformity with our invention, 4% bismuth and 1% titanium, its tensile strength becomes 33 to 35 kg per squ. mm, and its elongation is 20 to 24%.

As to reduction of area, this is 20 to 28% in the old alloys referred to, and is increased to about 30 to 33% by the additions of bismuth and titanium according to our invention.

As a further development of our invention, we have found that an addition of silver at the rate of 0.1 to 5% is favorable in our novel alloys since it increases the tensile strength without appreciably influencing its elongation and reduction of area. In the alloys referred to by way of example, addition of silver results in tensile strengths of 35 to 37 kg per squ. mm, with about 26 to 18% elongation.

The hardness of our alloys can be improved by adding lithium at the rate of 0.02 to 3% by which, in the alloys aforesaid, the hardness is increased for about 10 to 15%.

It will now be understood that our invention comprises adding to a magnesium alloy of any desired composition in other respects, bismuth and titanium at the respective rates of 0.5 to 8%, and 0.2 to 4%. To these alloys we may add 0.02 to 3% lithium and/or 0.1 to 5% silver.

Considering the usual magnesium alloys, an alloy according to our invention contains aluminium, cadmium, lead, tin, zinc, thallium, etc., each at the rate of 0.1 to 14%, and the said elements may be added separately or collectively. To an alloy of this usual kind, we add 0.5 to 8% bismuth and 0.2 to 4% titanium. If desired, we may also add 0.1 to 5% silver and/or 0.02 to 3% lithium.

The remainder in our novel alloys is substantially all magnesium. The phrase "substantially all magnesium" is intended to include magnesium and magnesium with minor amounts of customary impurities and auxiliaries. Such auxiliary alloying elements are, for instance, 0.1 to 2% each of manganese, calcium, silicon, or one of the metals of the iron group (iron, nickel, and cobalt) separately or collectively. Such and other auxiliaries are usual in magnesium alloys and they do not influence the characteristic properties of our novel alloys. However, the magnesium base must be at least 50% of the alloy, and preferably is 75 to 80%.

Preferably, an alloy according to the invention contains, besides 0.5 to 8% bismuth and 0.2 to 4% titanium, as described, one or more metals selected from the group comprising aluminium, cadmium, lead, tin, zinc, and thallium, at the rate of 0.1 to 49.3%, preferably 0.1 to 24.3%. The remainder of the alloy is substantially all magnesium and, as stated above, must be at least 50%. Preferably, it is 75%.

A preferred alloy according to our invention is one with 0.5 to 8% bismuth, 0.2 to 4% titanium, and 0.1 to 19.3% of one or more metals selected from the said group. The remainder which must be at least 80%, is substantially all magnesium.

Preferably, the alloys according to our invention contain, besides the said 0.5 to 8% bismuth and 0.2 to 4% titanium, 0.1 to 14% aluminium, under all conditions. To this may be added cadmium, lead, tin, zinc, and thallium, at the rate of 0.1 to 14% each, separately or collectively, but the base of substantially all magnesium must again not be less than 50% and preferably 75 to 80%.

Besides the auxiliaries in the remainder of

substantially all magnesium that were mentioned above, the remainder may also contain, if desired, 0.1 to 3% zinc, or 0.1 to 5% silver, or 0.02 to 3% lith-ium. As mentioned, the said auxiliary elements may be added, in the proportions indicated, separately, or two or more of them together, in any selected combination. They are intended to improve certain properties of the alloys but do not influence the characteristic properties of the novel alloys according to our invention.

In the following tabulation, some more examples of alloys according to our invention are given, it being understood that for all alloys in the tabulation the remainder is substantially all magnesium as defined above, that is, magnesium with or without the aforesaid minor amounts of customary impurities and/or auxiliaries.

Examples

[Content of constituents, per cent]

No.	Bi	Ti	Al	Zn	Cd	Pb	Sn	Tl
1	0.5–8	0.2–4	0.1–10					
2	0.5–8	0.2–4	--------	0.1–5				
3	0.5–8	0.2–4	0.1–10	0.1–5				
4	0.5–8	0.2–4	1–14	1–14	1–14			
5	0.5–8	0.2–4	1–14	1–14	1–14	1–14		
6	0.5–8	0.2–4	1–14	1–14	1–14	------	1–14	
7	0.5–8	0.2–4	1–14	1–14	1–14	------	------	1–14
8	Alloys Nos. 1 to 7, with 0.1 to 2% of one or more of the auxiliary metals, Mn, Ca, Si, Fe, Ni, Co, and similar combinations.							

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ALIEN PROPERTY CUSTODIAN

PROCESS AND A DEVICE FOR IMPREGNATING CONDENSERS

Berthold Springer, Berlin W. 30, Germany; vested in the Alien Property Custodian

Application filed November 13, 1939

The present invention relates to a process and a device for impregnating condensers with impregnating agents which are solid at ordinary temperature, as for example paraffine, ozocerite, vaseline and similar substances.

As is known, fixed condensers and the like are usually impregnated in such a manner that the condenser rolls, which for instance exist of metal foils with interposed impregnable insulating sheets after being dried in vacuum at an elevated temperature are flooded with the molten impregnating means.

The present impregnating processes show the disadvantage that the electric properties of the finished condensers deteriorate very much owing to the volume contraction which takes place together with the solidification of the impregnating agents, especially after long storage. This is besides other reasons mainly caused by the fact that owing to the volume contraction during solidification near the ends of the finished roll the solid impregnating agent shows series of small cracks. The water coming from the air which slowly penetrates into these cracks causes deterioration of the electric properties of the condenser. With certain kinds of rolling, as for instance the rolling of noninductive condensers, the influence of the cracks can be especially troublesome. Till now it has been tried to improve the disadvantage of decreasing the dielectric strength by making the insulating coils considerably larger than the metal foils.

The present invention intends to abolish the appearance of disturbing cracks by suppressing the volume contraction of the impregnating agent. This contraction takes place during solidification. When impregnating condensers with impregnating agents which are solid at room temperature, according to the present invention, the impregnating agent is at first, starting at room temperature, liquefied in a cyclic process and in presence of the condenser submitted to such high temperatures and such high pressures that the volume of the impregnating agent, whether totally liquid or partly liquid and partly solid, is reduced to the volume which the impregnating agent takes at room temperature and at atmospheric pressure.

The process according to the invention is explained in the following with the isobars for the liquid and solid state of a pure impregnating agent in a diagrammatic drawing. It is to be understood that according to the invention impregnating agents consisting of mixtures can be used.

Curve p_1 shows the isobar of a certain amount of an impregnating agent in solid and liquid state under atmospheric pressure. The volume of this amount at room temperature is called v_r. The curves p_2 and p_3 show the isobars of the same amount at considerably increased pressures p_2 and p_3, respectively. The changes in volume which take place at the melting temperatures T_1, T_2 and T_3 are called w_1, w_2, w_3. They decrease, as can be seen in the drawing. with increasing pressures. The process for impregnating of condensers can be realised according to the invention in many different kinds of cyclic processes which suit the constants of the used impregnating agents.

In curve I of Fig. 1 merely one way of conducting the cyclic process is shown. The impregnating agent is heated at atmospheric pressure to a temperature which is higher than the melting point and higher than the temperature T_3. At constant temperature the pressure is raised from p_1 to p_3, the impregnating agent remaining liquid and assuming a volume which is equal to its volume at room temperature. After that it is cooled to ordinary temperature at constant volume.

By reducing the impregnating agent to the desired volume (v_r) in a liquid state, as described above, the solidification occurring at the following cooling as well as the further reducing down to ordinary temperature takes place without any change in volume, which could be disturbing by the formation of troublesome cracks.

In the above described performance of the process according to the invention generally comparatively high pressures and corresponding high temperatures have to be used. Therefore, in a preferred method of performing the cyclic process according to the invention, the impregnating agent which has to be treated is exhibited at a temperature above its melting point (at 760 tor) to such a pressure that it solidifies and then it is cooled at the same or at a higher pressure isobarically to its volume at ordinary temperature.

Such a cyclic process is shown in Fig. 2, curve II, of the accompanying drawing.

The impregnating agent is heated at the pressure p_1, which may differ from the atmospheric pressure, to the melting temperature T_2 corresponding to the isobar p_2, then exhibited to the pressure p_2 what makes it solidify, and is cooled to such a degree, for instance isobarically, until it assumes the desired volume (v_r).

The above described method has the effect that

owing to the pressure p_2 being far above atmospheric pressure, the contraction of volume (w_2) connected with solidification is considerably smaller than the contraction of volume (w_1) at the melting point (at 760 tor). The contraction connected with the isobaric cooling of the solid material at the pressure p_2 has to be kept sufficiently small by choosing sufficiently high pressure in order to prevent troublesome cracks. Furthermore, the formation of undesired cracks at the ends of the condenser roll according to the contraction of volume during solidification cannot occur in the cooling of the impregnating agent in the solid state.

It is also advantageous to submit the impregnating material, which is to be treated, at a temperature above the melting point (at 760 tor) to a pressure at which the impregnating agent is still liquid, whereupon it is solidified by cooling at constant volume and reduced to the volume which it assumes at ordinary temperature. In Fig. 3, curve III, is shown, for instance, one way of conducting this kind of cyclic process.

The impregnating agent is heated at the pressure p_1 which may be equal or different from atmospheric pressure to a temperature higher than the temperature T_2. It is then submitted to a pressure higher than the melting pressure p_2 corresponding to T_2, remaining liquid. It is cooled isochorically to the temperature T_2, whereby the impregnating agent solidifies. Then it is whether cooled isobarically or at first compressed in the solid state to the volume (v_r) at T_2 and then cooled to ordinary temperature at constant volume.

In this method of carrying out the process according to the invention an important part of the volume reduction takes place in the liquid state before the solidification of the impregnating agent starts, and therefore the formation of cracks during solidification is practically eliminated.

In realising the process according to the invention, the cyclic processes illustrated in the diagrammatic drawing may generally not be obeyed strictly. The different tracks in the (v—T) plane may not be completely isotherm or isobaric; for instance the compression in the cyclic process II, illustrated in Fig. 2, may not take place at the exactly constant temperature T_2, nor may the cooling follow strictly parallel to the T-axis. Generally in the practical performance a cyclic process is chosen which avoids the formation of cracks and also works with temperatures and pressures which can easily be obtained in the practically available devices. Such a cyclic process can generally be pictured as an entirely enclosed curve in the (v—T) plane.

As the numeric constants of the usual impregnating agents are not known, in the following a homogeneous substance is used for demonstrating the pressures and temperatures used in the process according to the invention. This substance may have the following constants:

The melting temperature at 760 tor be $T_1=50°$ C; the change in melting temperature with pressure be 4.10^{-3} degree/atm. 1 gram of the substance shall take at ordinary temperature a volume of 1 cc. The relation between volume, temperature and pressure be the same for the solid and the liquid state and the thermal expansion coefficient be 5.10^{-4} and the compressibility 2.10^{-5}. The contraction of volume during solidification at atmospheric pressure be

$$w_1=5.10^{-2} \text{ cc/gr}$$

and the decrease in the contraction of volume with pressure be 4.10^{-6} cc/atm.

The figures given above correspond roughly to the figures of known substances, as for instance cetylic alcohol, decan etc. as can be seen from the tables of Landolt-Börnstein, the International Critical Tables etc., and from the publications on which these figures are based. The impregnating agents used practically do not differ principally in their behaviour from homogeneous substances.

Assuming a pure substance with the above mentioned constants, the following picture is obtained for the cyclic process shown in Fig. 1 by I, which requires especially high pressures and temperatures, as compared with the cyclic processes in Figs. 2 and 3.

1 gram of the impregnating agent is heated at a pressure of 760 tor from ordinary temperature to its melting point of 50° C expanding .015 cc. The change of volume during melting amounts to .05 cc. The molten substance is further heated to about 61° C expanding .006 cc. At this temperature it is exposed to a pressure of about 2500 to 3000 atm, which makes the volume decrease to its volume at ordinary temperature and 760 tor.

If substances are used the volume contraction of which changes stronger with pressure than it is the case with the above mentioned substance, considerable smaller pressures, as for instance up to 1000 atm., are sufficient in the cyclic processes corresponding to Figs. 2 and 3.

For quite different purposes, namely for rendering harmless the traces of gas which remain in the badly evacuated condenser rolls, a small over pressure of several atmospheres has already been used on the liquid impregnating agent. It can be seen that the pressures used in the process according to the invention are of a different order of magnitude.

In Fig. 4 are shown diagrammatically the essential parts of a device adapted for performing the process according to the invention. The impregnating vessel 1 consists of a number of pressure chambers 2, suitable for taking the condenser rolls which can be tightly closed at 3. The chambers 2 are connected via bore holes 4 with the pipe line 5. This line is connected with the evacuating device 9 via valve 8. By valve 10 it is separated from the container 11 which is filled with the impregnating agent, and by valve 12 from the high pressure part 13 and the medium pressure part 15 of the compressor.

After feeding the chambers 2 with condenser rolls, container 1 is heated by an electric heater 7 fixed in an insulating envelop 6. At the same time the air expands out of the chambers through the opening of valve 8. After closing the valve 8, the impregnating agent molten in the container 11 is allowed to enter by opening the valve 10 into the lines 5 and 4 which are all heatable and heat-insulated. According to the process which has to be carried out, and according to the impregnating agent used, at first a medium overpressure may be produced with the compressor 15 in the chambers 2 which at the same time have to be heated to a suitable temperature. After closing the valve 10 the highpressure device 13 can be fed under medium pressure with impregnating agent from the compressor 15, valve 14 being open, and after opening valve 12 the chambers 2 can be put under the desired highpressure. All the auxiliary devices, as thermometers, electrical and mechanical manometers etc. are omitted in the drawing.

As mentioned at the beginning the process according to the invention can be applied with special advantage for impregnating non-inductive condensers of known construction. Such a condenser is shown diagrammatically in section in Figs. 5, 5*a* and 5*b*.

One of the electrodes of the condenser is formed by the metal foils **17** interconnected at **19**, the other electrode being formed by the foils **18** connected at **20**. Adjoining metallic turns are separated by impregnable insulating layers **16**. The higher the wanted dielectric strength of the condenser has to be, the less the layers **17** and **18** can overlap. The free border given by the distance between **21** and **22** has to be sufficiently large, what increases the length of the condenser if the capacity is kept at a constant value. Even with large borders sparking-over cannot be avoided with certainty. For explanation of this fact it is referred to Figs. 5*a* and 5*b* which reproduce the inner edge **22** of the border in large scale. Fig. 5*a* shows a condenser impregnated according to the known process and Fig. 5*a* according to the process according to the present invention, the impregnating agent being marked **23**. In the known process of impregnation small cracks and bigger cavities are formed by the strong volume contraction of the impregnating agent during solidification (compare Fig. 5*a*).

This does not assure in the region of the border safety against sparking especially after the penetration of moisture into the cracks.

By the process of impregnation according to the invention, however, a considerable uniform filling **23** free from cracks is achieved in the border region (compare Fig. 5*b*). As experiments have shown, by the process according to the invention a multiple increase in strength of breakdown is obtainable. Even with small borders safety against sparks around the border is obtained. Therefore, non-inductive condensers of a certain capacity can be manufactured with considerable smaller length with the present process than with the known processes.

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[illegible]

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B. SPRINGER
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304,193

2 Sheets-Sheet 1

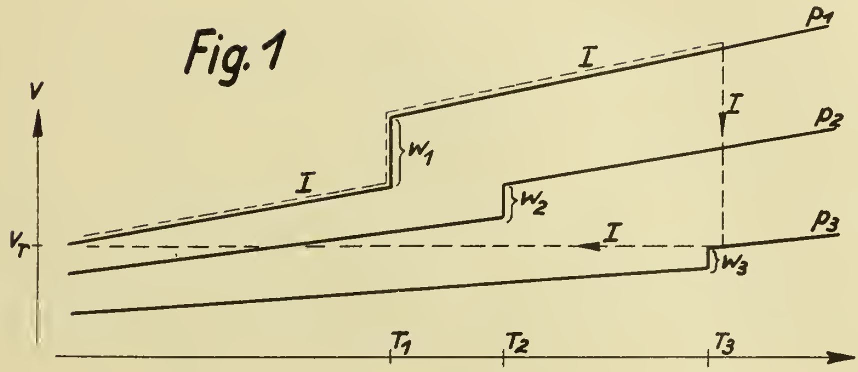

Fig. 1

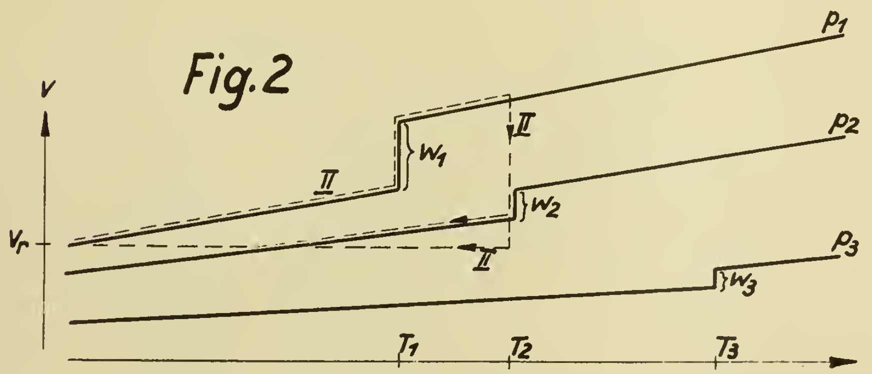

Fig. 2

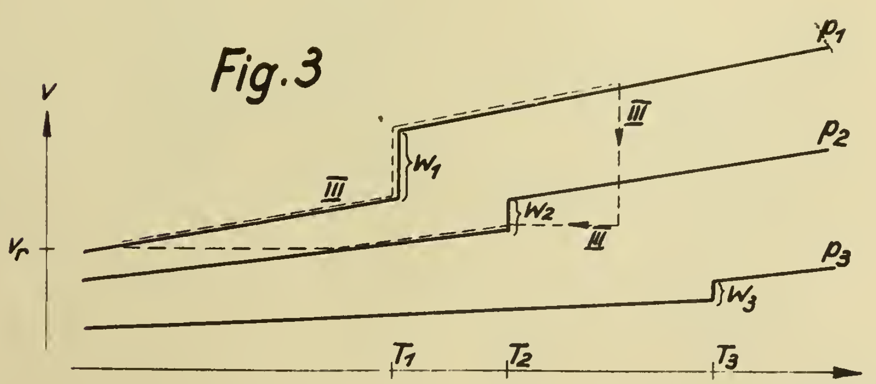

Fig. 3

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Fig. 4

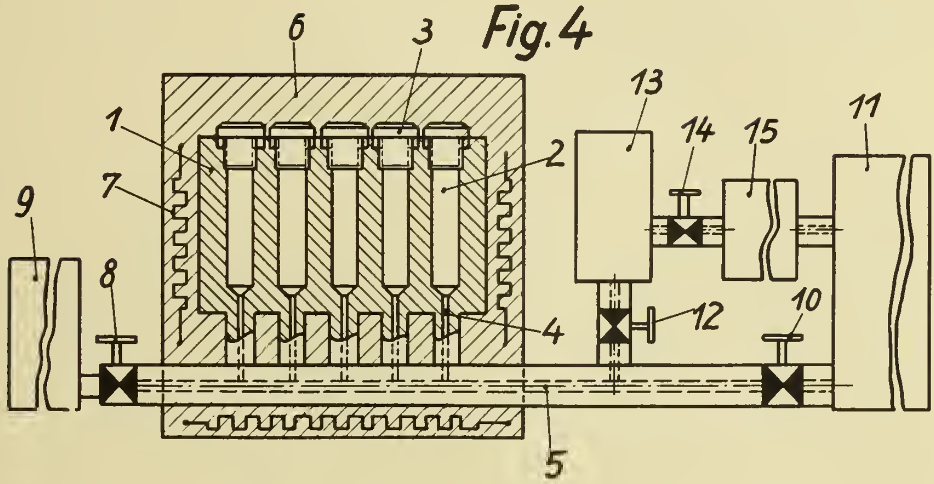


Fig. 5

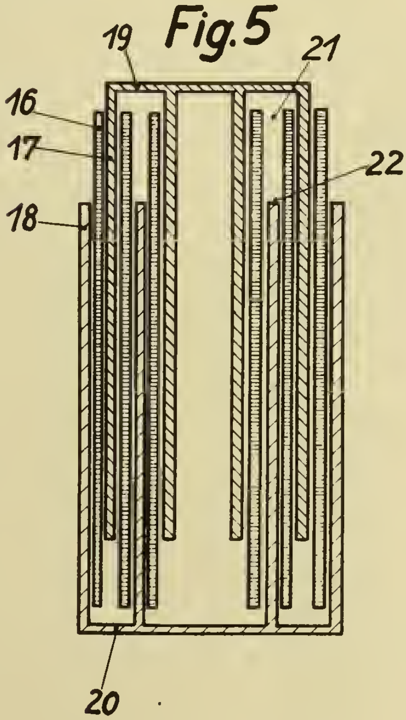


Fig. 5a

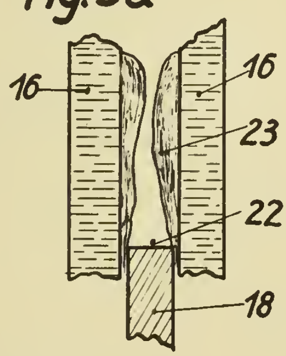
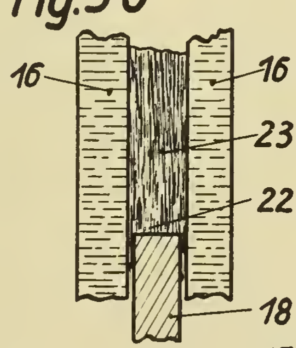


Fig. 5b



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ALIEN PROPERTY CUSTODIAN

CONTROL MECHANISM FOR AIRCRAFT

Karl Henke, Bremen, Germany; vested in the Alien Property Custodian

Application filed November 16, 1939

The present invention relates to a system for operating rudders in aircraft.

Control systems for aircraft have been proposed in which the ratio of transmission between the controlling member, for example, a stick, and the member to be controlled, for example, a rudder, changes automatically in a predetermined manner during operation of the system. It is desirable to make the change of transmission ratio dependent on the deviation of the member to be controlled.

For controlling or steering aeroplanes, it is desirable that, in the neighborhood of the centre or neutral position, comparatively small deviations of the member to be controlled, for example, the rudder, are produced by relatively large movements of the controlling member, for example, the stick, and that in the range of larger deviations or control movements away from the centre or neutral position, the movements of the rudder or the member to be controlled are gradually accelerated, so that at first the movement of the rudder lags behind that of the stick, and when reaching an end position, the movement of the rudder leads that of the stick. There is no linear relation between the movements of the controlling member and the member to be controlled. Various means have been proposed to solve the above set forth problem. The conventional mechanisms inherently have plenty of play and the member to be controlled, for example, the rudder, tends to flutter at certain operating conditions. Coulisse guides and similar means have been proposed; such means are subject to wear and are inferior to the mechanism according to the present invention which is composed of levers.

According to the present invention, the problem is solved by the provision of mechanical movement transmitting means, including a lever mechanism, made of novel construction, which is interposed between the controlling or manipulated member and the member to be controlled.

Further and other objects and advantages of the present invention will be apparent from the accompanying specification and claims and shown in the drawings which, by way of illustration, show what I now consider to be preferred embodiments of my invention.

In the drawings:

Figure 1 is an isometric diagrammatic showing of the mechanism, according to the present invention.

Figure 2 is a diagrammatic top view of a modified mechanism, according to the present invention.

Referring more particularly to Figure 1 of the drawings, it will be observed that the mechanism, according to the present invention, does not include gliding members, such as coulisses. The mechanism, according to Figure 1, may be arranged to produce a self-braking and self-locking effect, in the neighborhood of its centre or neutral position, so that movements of the rudder, caused, for example, by wind forces, cannot be transmitted to the stick, although movements of the stick are always effective on the rudder.

The mechanism is preferably mounted on a base plate or suitable casing 14. Three fulcrums, or pins, 5, 8 and 12, are fixed to said base plate. Levers 4, 7 and 11, respectively, of suitable length and configuration, are adapted to swing about said fulcrums.

A substantially triangularly-shaped coupling element 15, carries at its corners articulation pins 1, 2 and 3. Pin 1 is connected to the end of driving lever 4, which swings about pin 5, which is rigidly connected with plate 14. Driving lever 4 may be operated by means of control wires 6, which connect lever 4 with a steering wheel, a stick or the like. Pin 1 swings on an arc. Pin 2 is connected with the end of lever 7 and its distance from fulcrum 8 is maintained at all operating positions so that the movements of the coupling triangle 15, particularly of pin 3, are definitely determined; pin 3, as every other point of triangle 15, moves along so-called coupling curves. To pin 3 one end of pusher rod 9 is movably connected. The other end of pusher rod 9 is articulated to pin 10 at the end of driven lever 11. Pin 10 moves on an arc about fulcrum 12. Control wires 13 or the like are connected with lever 11 and transmit the movements of lever 11 to the member to be controlled, for example, a rudder, an aileron or the like. By suitably arranging size, distance and configuration and location of the individual members of the transmitting mechanism, a great variety of transmission ratios and characteristics can be obtained, so that in spite of the unsymmetric, kinematic arrangement, a symmetric effect is produced as is desired for control systems with which the invention is concerned. A self-braking or self-locking effect, in the neutral position of the system, may be produced by arranging pins 1, 3 and 5, as well as pins 2, 3 and 8, in a straight line, when the system is in neutral or centre position. In the arrangement shown

in Figure 1, only the first of the above set forth two conditions are fulfilled, and a self-braking effect is not produced in the system, according to Figure 1.

A self-braking effect is obtained when arranged as in Figure 2. This self-braking arrangement is shown in self-braking position, whereby the rudder or aileron **16** and the system are blocked against actions on the rudder itself. In the mechanism, as shown in figure 2, instead of control wires **6**, or the like, a connecting rod **6'** is used, and instead of the substantially T shaped levers **4** and **11**, bell crank levers **4'** and **11'** are used. Instead of connecting wires **13**, a connecting rod **13'** is employed. Fulcrum **8'** of the system, according to figure 2, is not in fixed position with respect to the base plate **14**. The position of fulcrum **8'** can be changed, for example, by manipulating the crank **17** of the threaded spindle **18**. By changing the position of fulcrum **8'**, the characteristics of the transmission of the movements of stick **19**, with respect to the movements of rudder **16**, can be changed while the system is in operation. Adjustment or change of the transmission ratio is desirable, for example, for the operation of transverse rudders or ailerons; when the aeroplane moves at high speed, no great effect of minor movements of the control stick or wheel on the ailerons is needed; whereas a self-locking effect is desirable, on the other hand, when operating at low speeds. Particularly when the aeroplane floats towards the landing field, the self-locking effect is without importance, whereas it is highly desirable that small movements of the stick produce large movements of the ailerons.

The fulcrum of the auxiliary bearing **8'** may be connected to and automatically controlled by the landing flaps or similar auxiliaries which are operated when landing. By means of such an arrangement, the ailerons may be simultaneously used as landing flaps without impairing their controllability to produce the aileron effect; when the position of the control stick **19** is maintained, fulcrum or pin **1** is in fixed position; a change of the position of pin **8'** will then cause change of the position of pins **3** and **10**, and thereby of the aileron **16**.

The size of the mechanism as a whole is unimportant. Pin or driving shaft **5**, and pin or driven shaft **12**, may be located anywhere in the aircraft. On the other hand the whole mechanism may be built in a comparatively small box and inserted as a complete unit in an existing control mechanism and disposed, for example, in the fuselage bottom or stern, or in the shell of a wing.

While I believe the above described embodiments of my invention to be preferred embodiments, I wish it to be understood that I do not desire to be limited to the exact details of design and construction shown and described, for obvious modifications will occur to a person skilled in the art.

KARL HENKE.

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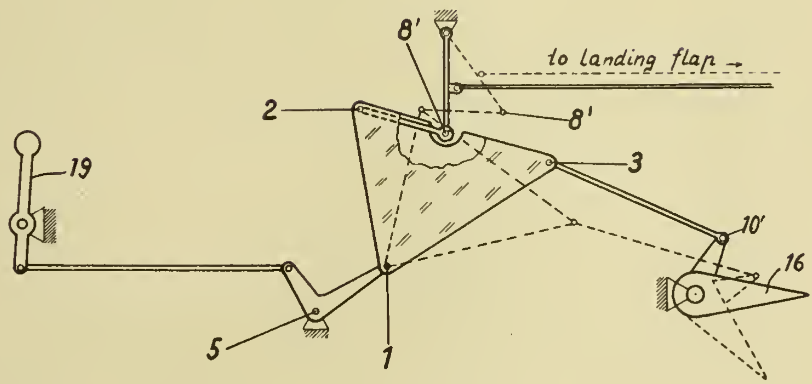
Fig. 3



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ALIEN PROPERTY CUSTODIAN

VIEW FINDERS

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Application filed November 16, 1939

The invention relates to improvements in view finders for photographic cameras and particularly is directed to ground glass focusing view finders which are built into a mirror reflex camera or which are mounted onto a camera casing.

The principal object of the invention is to provide a ground glass focusing finder which is viewed from the rear wall of the camera and produces an upright image of the object to be photographed without reversing the sides thereof.

Another object of the invention is to employ for the production of an upright finder image a prism reversing system which is arranged in the path of the light rays between the finder objective and the ocular or viewing aperture of the finder.

Still another object of the invention is to employ as a prism reversing system two rectangular prism. Such an arrangement of the prism reversing system permits a compact construction of the camera.

The drawing illustrates diagrammatically one embodiment of the invention:

Fig. 1 is a vertical sectional view of a mirror reflex camera, and

Fig. 2 is a horizontal sectional view of the mirror reflex camera, substantially along the broken line II—II of Fig. 1.

The camera casing 1 is provided with a photographic objective 2 on its front wall 3. A curtain shutter 4 whose exposure slot is indicated at 4^a, is arranged in front of the focal plane in which the light-sensitive film 5 is positioned in customary manner. A conventional mirror 6 is mounted in the camera casing directly in the path of the light rays entering the objective 2 and in a position for normally deflecting an image of object to be photographed upwardly through an aperture 10 in a horizontal partition wall 11 onto a translucent screen 8 of the view finder mounted in the upper portion of the camera casing 1. When the image appears sharply on the translucent screen 8, which result is obtained by adjusting the objective 2, the camera is said to be focused correctly to produce on the film 5 a latent image of the object. When the shutter 4 is released the mirror 6 is automatically moved upwardly about its pivot axis 7 so that the objective 2 projects the image toward the film 5 and exposes the latter during the exposure movement of the shutter 4. The parts and their arrangement and actuation so far described are conventional and no further description of the same is believed necessary.

In accordance with the present invention a rectangular prism 12 is mounted in the finder chamber 13 above the partition wall 11 of the camera casing 1. The prism 12 is placed with one of its sides containing the right angle directly upon the translucent screen 8 or over the aperture 10 in the partition 11. Preferably, the translucent screen 8 is formed on the side of the prism 10 covering the aperture 10 by grinding this side of the prism to make it dull or translucent. A second rectangular prism 14 is placed with its hypotenuse against the other vertically disposed side of the prism 12 in a manner as illustrated in Fig. 2. It will be noted that the prism 12 covers about one-half of the hypotenuse of the prism 14 whose two sides containing the right angle are arranged vertically so as to reflect the light rays emitted by the prism 12 rearwardly into the ocular objective 15 mounted in the rear wall 16 of the camera casing 1. The two prisms 12 and 14 reverse the image of the finder, which image ordinarily would appear inverted as is well known in the art. The eye 18 of the photographer, when looking through the ocular objective 15 will see an upright image of the object to be photographed. The image appears exactly as one can see the object with both eyes, or in other words, no inversion of the sides has taken place.

It is believed obvious that the arrangement of the reversing prisms may also be employed in the so called twin lens reflex cameras, in which case the prisms are mounted in the finder compartment above the camera compartment, between the finder objective and the finder viewing aperture or ocular objective.

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VIEW FINDERS

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304,702

Fig.1

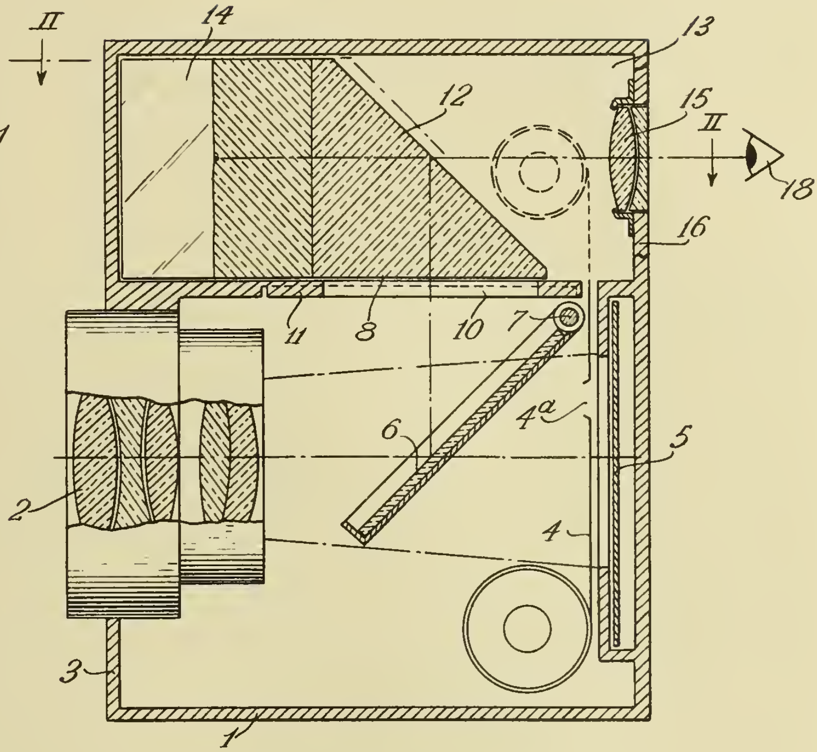
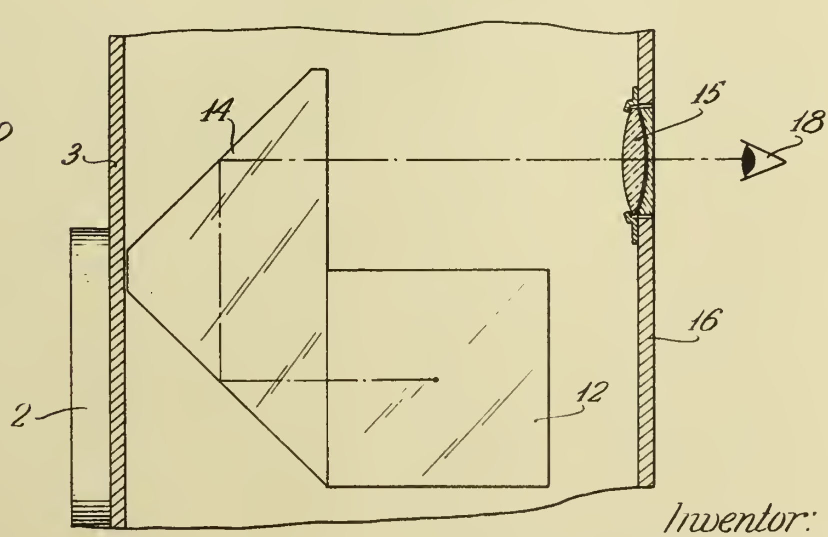


Fig.2



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ALIEN PROPERTY CUSTODIAN

UNIVERSAL DAMPER FOR THE TORSIONAL VIBRATIONS OF COAXIALLY REVOLVING SHAFTS

Raffaele Matteucci, Turin, Italy; vested in the Alien Property Custodian

Application filed November 16, 1939

Dampers of the torsional vibrations of rotating shafts are known in which the passive work for the damping effect, done at the expense of the energy transmitted by them, is effected in dependence on angular displacements of masses, with regard to the shaft, set up by their inertia reactions to the disturbances of the rotary motion set up by the said torsional vibrations.

It is also a known practice to fit to the resilient joints of revolving shafts, dampers of the oscillatory deformations of the resilient parts producing passive work at the expense of the said deformations.

Neither of these types of damper is able to damp out all the torsional vibrations of shafts. The former damp out only those vibrations which present to them the loop zone in which, as it is known, the rotary motion of the shaft is disturbed angularly, whilst they are not responsive to those vibrations which present to them the node where the rotary motion is not disturbed. The latter behave in exactly the opposite manner, being, that is, quite insensible to those vibrations which occur to them in the loop, as they do not modify the couple acting on the resilient joint, but come into action if, at the point at which they are mounted, there happens to be a node or a prevalently nodal zone of vibrations, as in such zones the torsional vibrations develop in the shaft torsional stresses.

Now the present invention has for its object the creation of a damper capable of acting universally on all torsional vibrations whether in a node or nodal zone, or in a loop or loop zone. Another object of the invention is to automatically vary the intensity of the damping effort in direct ratio to the variations in the speed of rotation. Yet another object is to be able to regulate the sensitiveness of the damper, while yet a further object is to be able to regulate this sensitiveness independently for the vibrations which act upon the damper in the loop zones and for those which act on it in the nodal zones.

This damper, which forms a group intended to be inserted between two coaxially rotating shafts, one driving and the other driven, is characterized by a selector consisting of an elastically deformable member mounted on the centre line of the shafts in such a manner as to be deformed in an oscillatory sense by the vibrations acting upon it with a node or with their nodal components, and by inertia masses angularly moveable around the shaft and arranged in such a way as to be moved in an oscillatory sense by those vibrations which act upon it by a loop or with their loop components; the said selector is in combination with damping members which transform the collected energy into passive work through the oscillatory deformations of the elastic member, and through the oscillatory displacements of the inertia masses.

Thanks to the selector formed by the elastically deformable member and the masses moving by inertia, there are collected on the cynetic energy transmitted along the centre line by all the torsional vibrations without distinction, two distinct and continuous currents of energy which are progressively transformed into passive work by the two transformer damper members, so that all the vibrations, without exception, are damped by the dissipation of the cynetic energy set up in them by the exciting impulses, or by opposing in other manner to the resonance.

This passive work, which can be performed in various ways: by friction, by the throttling of fluids under pressure, etc., will, hereafter, be called "damping effort".

The inertia masses of the selector may be fitted to one or both of the shafts connected by the resilient joint, seeing that the torsional vibrations which present to the damper loop zones produce in both shafts oscillatory disturbances of the rotary motion.

The damping transformer members which produce the damping effort are preferably blocks arranged in a circle coaxially around the shaft; these blocks, under the influence of centrifugal force or a combination of this and the action of springs or other known suitable means, press against the inner surface of an annular member which surrounds them and produce their effect by sliding on is, backwards and forwards, under the influence of the elastically deformable member, or, as the case may be, of the inertia masses.

Some forms of realization of the object of the invention are shown, merely by way of information, in the annexed drawing in which: fig. 1 is a longitudinal section of one form of the universal damper; figs. 2 and 3 are partial cross sections on the lines $2x$—$2x$ and $3x$—$3x$ of fig. 1; fig. 4 shows, on a larger scale, in longitudinal section, one form of execution of the damping members fitted with adjustable elastic means for regulating the intensity of their action; fig. 5 shows, still to a large scale, in longitudinal section, a form of execution of the damping organs provided with centrifugal means of regulating the intensity of their action; fig. 6 is, in its right half, a section on the line $6x$—$6x$, and in the left half, a section on the line $6y$—$6y$ of fig. 5; fig. 7 is, in the right

half, a section on the line $7x$—$7x$, and in the left half, a section on the line $7y$—$7y$ of fig. 5; fig. 8 shows in longitudinal section a second form of the universal damper; fig 9 shows a modification in cross section on the line $9x$—$9x$ of fig. 10; fig. 10 shows a section on the line $10x$—$10x$ of fig. 9; fig. 11 shows in cross section another modification. In all these figures the same numbers are used to denote similar or corresponding parts.

In the form of execution shown, by way of example, in Fig. 1, the damper is applied on the line shafting of a turbine driven ship. The propellor shaft 1 is driven round by the shaft 2 of an ordinary reducing gear driven by the turbine. In this application, the driving torque being constant and the resistant or load couple being also substantially constant and only disturbed by the rythmic impulses of the screw in the water, the amount of cynetic energy transmitted by the torsional vibrations is relatively small and therefore the elastic deformable member which serves to select and collect by its deformations the cynetic energy of the vibrations acting with a nodal character, has but a slight elastic work to perform. It is therefore constituted only by a bar 3, stressed by the driving torque to a high specific torsion load and which therefore effects fairly ample torsional deflections in consequence of the disturbances of the rotary moment set up in it by the torsional vibrations of nodal character. This bar 3 is arranged inside the shaft 2 of the reducing gear, which is hollow, and coaxially with it; its right hand end engages angularly with the shaft 2 by means of grooves and its left hand end engages in a similar manner with a hub of a drum 4 fixed to the end of the propellor shaft 1. At the left hand end of the reducing gear shaft 2, opposite the bottom of the drum 4, is fixed a disc 5 which presents a certain number of teeth 5′ regularly spaced and projecting from its left face. The teeth 5′, through an equal number of slots 4′ in the bottom of the drum, penetrate for a certain distance into an annular recess 4° arranged in the periphery of the drum 4, which recess is preferably divided into two compartments by an intermediate diaphragm 6, loose with regard to the drum. Between the said teeth 5′ are engaged angularly with regard to the centre line of the shaft, but free to move radially, an equal number of friction blocks 7 lodged in one of the two compartments of the recess 4°. These blocks 7, which form together a crown, make contact, with their faces furthest from the axis, with the inner surface of the peripheral recess 4° of the drum against which they are pressed in the manner which will be described later.

The nodal action vibrations disturbing the intensity of the driving torque applied to the elastic member 3, set up in it fluctuations of the deformations of the torsion and consequently cause a corresponding oscillatory displacement of the blocks 7 in the recess 4° of the drum 4. As these blocks are pressed against the inner surface of the recess 4° of the drum by centrifugal force, they produce, in their to and fro sliding on the said surface, the passive damping work on the nodal action vibrations.

Within the said recess 4° of the drum 4 is located, alongside the crown of blocks 7, a loose ring 8 which, reacting by inertia to the disturbances of the rotary motion set up in the drum 4 by the loop action vibrations, moves on it angularly with an oscillating motion. On this ring 8 is fitted a series of blocks 8° retained on the ring 8 in the direction of rotation of moveable pins 9 lodged in substantially radial slots cut partly in the thickness of the ring 8 and partly in the thickness of the blocks 8°, which are thus free to move in a radial direction under the influence of centrifugal force and are pressed against the internal surface of the recess 4° of the drum 4. When, by reason of loop action torsional vibrations, the inertia ring 8 is subjected to oscillatory angular movements with reference to the drum 4, the blocks 8° rub with a reciprocating motion against the inner surface of the recess 4° and perform the passive work of damping the said vibrations. The pressure exerted by the blocks 8° on the inner surface of 4° by the action of the centrifugal force developed in them and on the moveable pins 9, can be eventually integrated by springs 10 also located in suitable recesses in the ring 8 and in the blocks 8°.

The blocks 7 are pressed against the inner surface of the recess 4° by the action of the centrifugal force set up in them during rotation These blocks 7 can be provided, on their periphery, with a friction shoe 7°, similar to the blocks 8° of the inertia ring 8 and similarly retained on the relative block 7 by moveable pins 9′ lodged in slots cut in part in the thickness of the block 7 and in part in the friction shoe 7°. In this case the pressure exerted by the block on the inner surface of the recess 4° is equal to the sum of the centrifugal actions developed in the block 7, in the friction shoes 7° and in the pins 9′. Also in this case the pressure exerted by the blocks 7 can be integrated by springs 10′ lodged in suitable recesses in the block and in the friction shoe.

Thanks to the above described conformation the pressure with which both the blocks 8° of the inertia ring 8, and the blocks 7 with their friction shoes 7° are pressed against the inner surface of the recess 4°, abstraction made of the pressure exerted by the eventual springs 10 and 10′, is furnished by centrifugal force and is therefore proportional to the square of the speed of rotation of the whole, so that also the damping effort is proportional, the displacement of the blocks being equal, to the square of the said speed.

In fig. 4 is represented a form of an execution in which the eventual springs 10 and 10′, both on the inertia ring 8 and on the blocks 7, are adjustable, being mounted in threaded casings 11 and 11′, provided with a hole 12 and 12′ for a spanner, and screwed into threaded seatings 8 and 7 where they are then locked by the locknuts 13 and 13′. The aperture 14 made in the drum 4 allows of the passage of the spanner.

In fig. 5 is presented, on the left, the application of additional centrifugal means 15 acting on the blocks 8° actuated by the inertia ring 8 and acting through the levers 16 of continuous rectangular section located in the ring 8 in corresponding niches 8^a, fulcrumed on it at 17, abutting on the block through the protuberance 18, held in place axially by the pin 19 and by the cooperating plate 20 fixed by the screws 21 on the ring 8. Adjustment is effected by increasing or diminishing the weight of the masses 15.

In fig. 5, on the right, is represented the similar application of additional centrifugal masses 22 acting on the friction shoe 7° of the blocks 7 through the levers 23 of continuous rectangular section located in corresponding niches 7^a in the block 7, pivoted at 24 on the dividing wall 6, abutting on the friction shoe 7° of the block 7 through the protuberance 25, maintained axially in place

by the pin 26 which engages in a corresponding recess 27 in the block 7 cooperating with the dividing wall 6. The opening 28 made in the drum 4 and the opening 29 on the disc 5 allow the passage of the lever 23. Adjustment is effected by increasing or decreasing the weight of the masses 22.

It is therefore possible to regulate, whilst working, the tension of the springs 10, 10′ and the intensity of the centrifugal pressure of all the blocks.

In the form of execution in Fig. 1 the inertia mass 8 with its friction blocks 8° is fitted only to the shaft 1, but it is obvious that the application can also be made on the shaft 2.

In fig. 8 is represented diagrammatically the application of the damper to two shafts 1, 2, subjected to a driving torque affected by strong cyclic irregularities, as would be the case, for instance, in the coupling together in tandem of two Diesel engines without a flywheel. As in this case the quantity of cynetic energy transmitted by the vibrations is very considerable, the elastically deformable member which serves to select and gather by its deformations the cynetic energy of the vibrations acting with a nodal character has to perform a very large amount of elastic work and has therefore to assume the constructional forms and dimensions of a real and true flexible coupling of considerable power. In this case, whilst one part of the elastic deformations is utilized to perform the work of damping the torsional vibrations, another part of it reduces the cyclic irregularities of the driving torque and of the rotary motion dependent upon it, thus attenuating the stresses set up by the torsional vibrations produced by the said irregularities.

In fig. 8 is represented a coupling of the known type described under British Patents nos 508,425 and 510,104, under the name of the present applicant, which lends itself well to this application. Any other known type of flexible coupling may, however, be employed in its stead.

The inertia rings 8 and 8^b with their relative blocks for the damping of loop action vibrations, in every way similar to those already described, are mounted respectively on the drums 4^a and 5^a of the discs 4 and 5 which carry respectively the lugs 4^b and 5^b engaging with the elastic members 30 of the joint.

The blocks 7 for the damping of nodal action vibrations, revolving together with the disc 4 by means of special engagement pieces 31 fixed to the drum 4^a, but free to move radially, act on the drum 5^a revolving together with the shaft 2, through the joint action of oscillatory movements determined by the deformations of the elastic group caused by the nodal action vibrations, and by the pressure set up in them by any suitable means.

The assembly of the blocks which produce the damping effect forms three coaxial annular groups, located alongside the elastic group.

It is evident that, the lower the speed of the driving shaft, the larger must be the inertia masses of the selector intended to collect the cynetic energy of the vibrations acting on it with a loop or with loop components. In cases where the speed of the driving shaft is low it is therefore advantageous, in order to avoid the use of too large inertia masses, to increase the rotational speed of such masses, having recourse, for example, to the arrangement shown in figs. 9 and 10 where the drum 4, solid with the driven shaft 1, contains only the blocks for the damping of the nodal action vibrations. The drum 4 carries around with it in rotation one or more adherence rollers 32, of smaller diameter, two in the example illustrated, held in close contact with its periphery by suitable means. For this purpose the rollers 32 are carried on the arms 35, oscillating about 35′, which tend to be drawn towards each other by a spring 36, so that the two rollers are held in adherence with the drum 4 at diametrically opposite points. On the spindle 33 of each of the said rollers is mounted a secondary drum 34 containing the mobile inertia masses 8. These masses, since they revolve at a higher speed than the driving shaft, are of a smaller size than they would have to be if they rotated at the same speed as the said shaft. Instead of rollers, toothed wheels 32° may be employed, engaging with teeth on the periphery of the drum 4, as is shown in the other variant of fig. 11, or other suitable mechanical drives.

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UNIVERSAL DAMPER FOR THE TORSIONAL VIBRATIONS OF COAXIALLY REVOLVING SHAFTS

Filed Nov. 16, 1939

Serial No. 304,835

3 Sheets-Sheet 1

Fig. 1

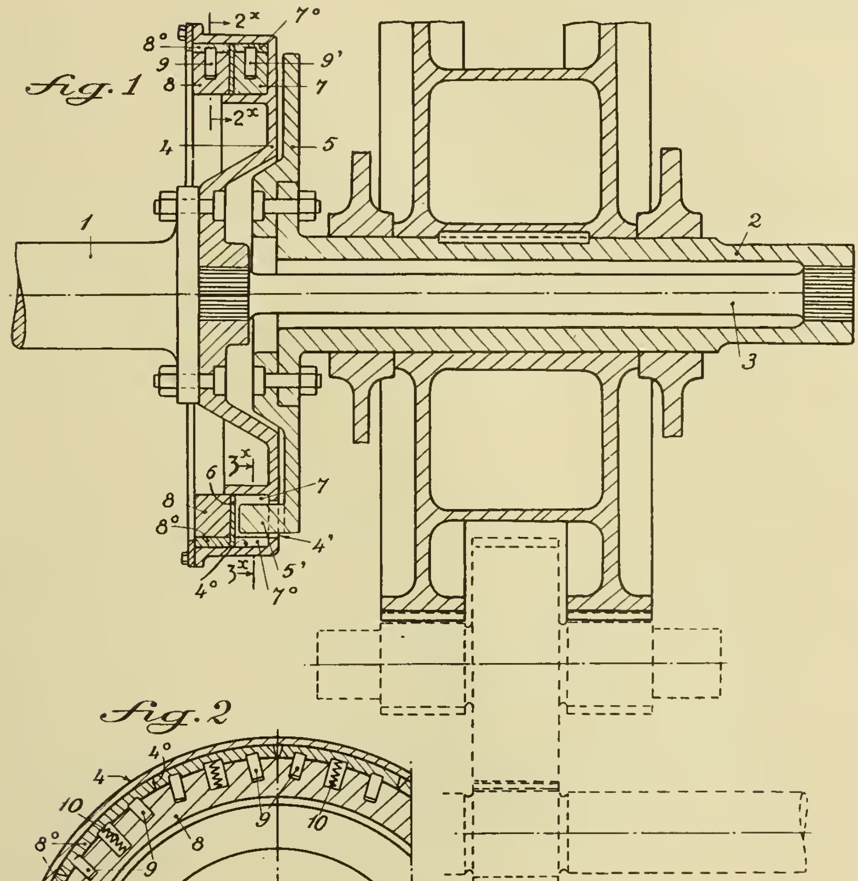

Fig. 2

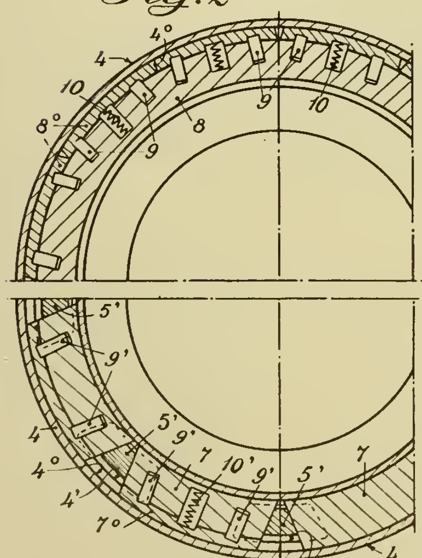

Fig. 3

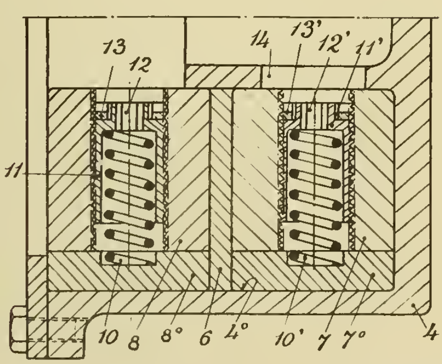

Fig. 4

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Serial No. 304,835

3 Sheets-Sheet 2

Fig. 5

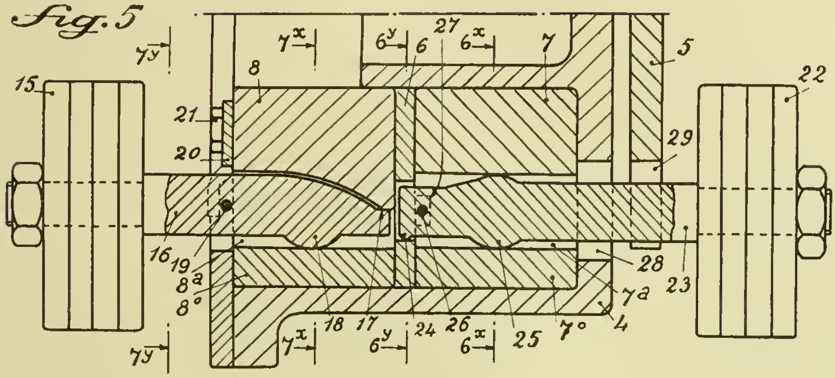


Fig. 6

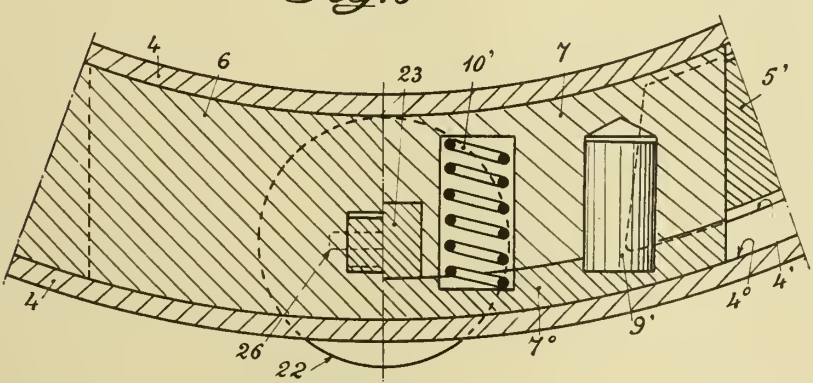


Fig. 8

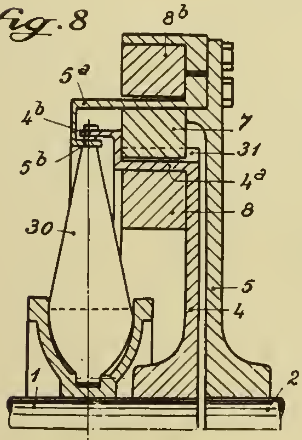
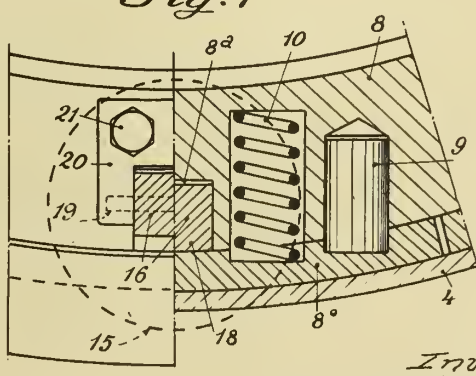


Fig. 7



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3 Sheets-Sheet 3

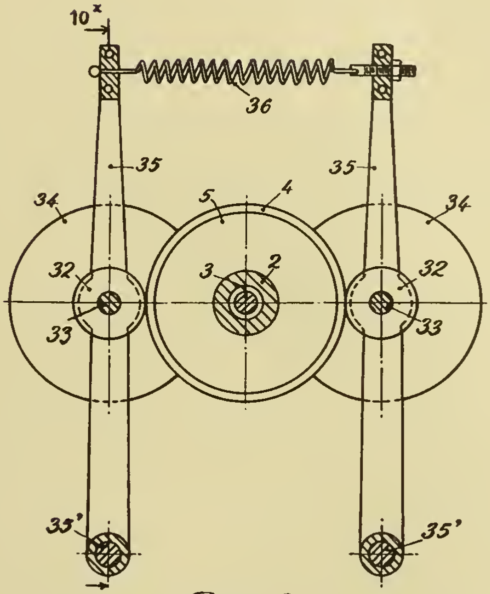


Fig. 9

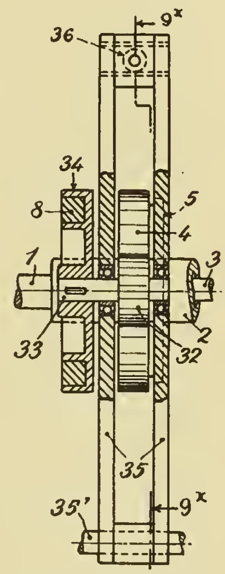
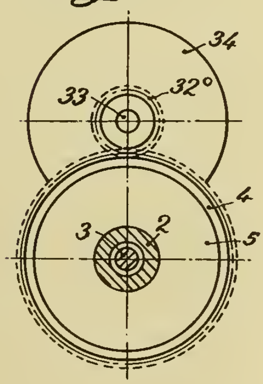


Fig. 10

Fig. 11



Inventor,
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By: Glascock Downing & Seebold
Attys.

Published May 4, 1943

Serial No. 305,403

ALIEN PROPERTY CUSTODIAN

PROCESS FOR MANUFACTURING SHEETS, FELTS AND MATS OF GLASS FIBRES BY THE WET PROCESS

Secondo Marocco, Milan, Italy; vested in the Alien Property Custodian

No Drawing. Application filed November 20, 1939

The processing of the glass wool obtained by various means, has been heretofore conducted, as far as my knowledge goes, exclusively in the dry way, on machines like or similar to those used in the textile branch, or else exclusively by hand.

According to the wet process for manufacturing sheets, felts, mats of glass wool, the fibres are immersed in water properly mixed so as to obtain a suspension of the various fibres which are then filtered through metal wire netting, woven fabrics or other convenient surfaces; once the wet mat is obtained it is strained and dried. Due to the fact that the fibres are setting freely, a perfectly uniform layer is obtained, which can be adjusted both in relation to the quantity of water used and to the quantity of mixture subjected to filtration.

During the suspension in water the fibres of glass may be mixed with glueing materials, or with fibres of a different nature, or with colouring matter, or with any other desired ingredient, to the object of altering even substantially the appearance of the product.

The advantages of the wet process consist in the fact that:

(*a*) All the processing is conducted mechanically, which avoids serious and antihygienic conditions of work for the operators, as every dry manipulation of the fibres is eliminated, which manipulation causes a considerable amount of glass powder and short fibres which remain in suspension in the air and cause painful wounds to the naked hands.

(*b*) A greater regularity in the manufacture of felts, which may be obtained in any thickness desired, and absolutely uniform, offering the means of reproducing at any time the characteristic features of a product manufactured at other times.

(*c*) The felts and mats have a specific gravity which is lower than that of the same product made by hand.

(*d*) A lower heat transmission factor and higher antiacoustic features, other conditions being equal, than the same product hand-made, due to the fact of a more regular deposit or setting of the fibres.

SECONDO MAROCCO.

Published May 4, 1943

Serial No. 306,518

ALIEN PROPERTY CUSTODIAN

PROCESS AND DEVICE FOR OBTAINING THE PROJECTION OF LUMINOUS LETTERS AND DRAWINGS, PARTICULARLY FOR THE PURPOSE OF PUBLICITY AND SIGNALLING

Mario Fioroni, Rome, Italy; vested in the Alien Property Custodian

Application filed November 28, 1939

The present invention concerns a new process for obtaining the projection of luminous letters and drawings, particularly for the purposes of publicity and signalling. This new process is based essentially on the direct projection of luminous or incandescent objects and allows of the production, by means of a lens, of images of great luminosity.

The method known hitherto and more in use for obtaining the projection of luminous letters and drawings is characterized by the fact that the object to be projected is obtained by transparency, or its outline is fixed on a transparent background and illuminated by a source of light at the back thereof.

The process forming the subject matter of the present invention is instead substantially characterized by the fact that the object to be projected is obtained by making use of the body or luminous filament of electric bulbs and is, therefore, made of a material meant to become luminous or incandescent. The object and the source of light form thus an undivided whole, and that is a luminous or incandescent body of which a lens supplies the image which will appear so luminous and incandescent as to be clearly visible also by day-light with effects hitherto unknown.

The practical realization of this new process, a form of embodiment of which will be illustrated hereinafter, may be destined especially for obtaining projections of great luminosity for publicity advertisements and for signalling, with the following appreciable advantages:

1st.—Possibility of obtaining luminous images visible also by day-light, or in illuminated premises.

2nd.—Possibility of being able to change easily a writing or a drawing, and of directing the projection to any desired place (foot-path, facades of buildings, interior of shops and of show-windows, etc.).

3rd.—Possibility of being able to easily render the projection intermittent or movable, thus obtaining many publicity effects.

4th.—Economy in manufacture, installation and up-keep.

By way of example, in the figures of the annexed drawing there is illustrated one of the possible practical embodiments of the process in question, and precisely there is shown a device which allows of the projection of luminous letters.

In said drawing:

Fig. 1 is a diagrammatic view of the outlines of the letters M. N. V to be projected, obtained by using the filament, duly shaped, of incandescent electric bulbs;

Fig. 2 is a plan view, in horizontal cross section, of one of the projection devices in accordance with this invention;

Fig. 3 illustrates diagrammatically a support apt to hold the projection devices;

Fig. 4 illustrates, side upper most, the apparatus for obtaining the luminous projection of the word "LUX."

As is shown by said drawing in which the same numbers distinguish the same parts, Fig. 1 represets a form of embodiment in which, in order to obtain the incandescent outline of the object to be projected, use is made of the body or luminous filament of incandescent electric bulbs. The threads of refractory metal (and for this purpose the more adapt is tungsten), meant to become incandescent in consequence of the passage of the electric current, are extended horizontally with regard to the support and, sustained by the little hooks, they are arranged so as to form the outlines of the three letters M. N. V.

It is obvious that, by resorting to the same system, one can obtain the outlines of any other letter of the alphabet, or of any special sign which may be needed to form a drawing.

The projection apparatus may vary according to the requirements of practical realization; in Fig. 2 there is represented only diagrammatically a very simple device made of a case 1 in which is enclosed the special bulb 2 which contains outline 3, apt to become incandescent, of the object which it is desired to project; the object glass 4, which may be made of one double convex lens only, or of a system of lenses, supplies the luminous and enlarged image 3′ of the said object. The lens is fixed to a case 5 with turning annular packing for bringing into focus, while case 1 is meant to be fixed to a Cardan or spherical joint 6 to enable one to direct and fix the projection in the manner desired.

Fig. 3 represents diagrammatically a support 7 fit to contain three projection devices which are fixed in holes 8—9—10, while Fig. 4 represents the three device 8′—9′—10′ mounted together on the same support 7′ so as to obtain the luminous projection of the word "LUX."

Besides the one described above, there can be many other practical appliances or realizations of the new method in question, especially as regards both the particulars of construction and the material employed to obtain the luminous or incandescent outlines of the object to be projected, in particular in air-ports for signalling during landing and taking off at night, as well as for special auxiliary signalling from motor-cars travelling during the night, as also with regard the device which allows of the luminous projection of the object, (a writing, a drawing, cypher, and the like), which may consist either of the union of several outlines projected by one or more devices, or one single outline constituting the whole object and projected by one apparatus only, without, however, coming out from the aim of the present invention.

MARIO FIORONI.

[illegible]

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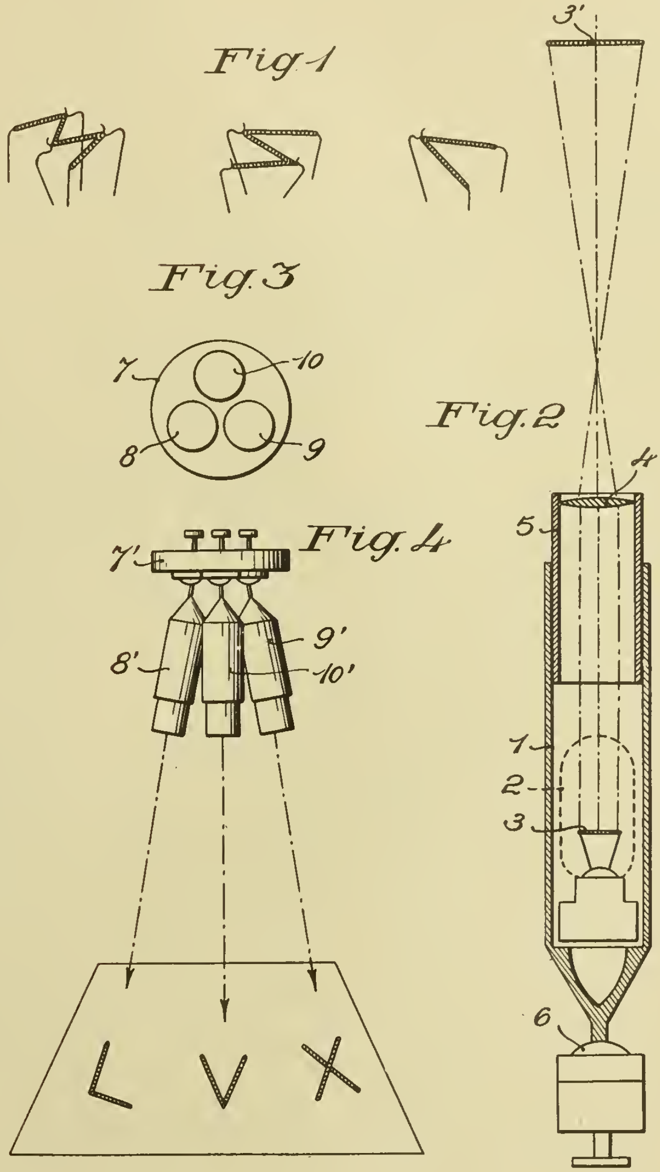

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Attorney.

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ALIEN PROPERTY CUSTODIAN

PROCESS FOR THE PRODUCTION OF GLUTEN POWDER

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No Drawing. Application filed December 2, 1939

It is already known that the baking properties of flour may be considerably improved when there is added wet gluten or other improvement means to the dough made of the flour. Wet gluten is for instance produced by washing the starch out of wheat flour, and there is thus produced an elastic gluten mass that contains about 60% of water. Such a gluten mass may be kneaded to a dough. If the dough is made of flour of a soft wheat, by which is meant a wheat having a small content of protein, the addition of gluten will improve the dough in such a manner that it will bake as though it were made of a hard wheat, that is a wheat having a high content of protein (gluten).

Gluten mass containing as much as 60% of water is, however, not durable. It has been found difficult to find a useful employment in baking of that gluten which is produced as a by-product of wheat starch. It has been proposed to dry gluten disposed upon trays or within drums by means of either a current of hot air or a vacuum, but the gluten powder obtained in this manner after mixing it with water will not provide a gluten possessing the same good baking properties as the original wet gluten.

The object of the present invention is to produce a gluten powder that possesses highly improved baking properties, and this is obtained by dissolving or emulsifying wet gluten produced in known manner, in an aqueous solution that has a suitable concentration of hydrogen-ion (pH ranging between 3 and 7), to the effect that the gluten undergoes an alteration from being an elastic mass to become a cream-like mass, and in strong concentrations a paste-like mass. The mass produced may be spread in a thin layer on a tray or within a drum, and may subsequently be atomized in such a manner that the drying process may be carried out without injuring the original properties of the gluten. The thus uninjured powder produced will after being mixed with water provide a wet gluten that is just as elastic as the original gluten.

In order to obtain a good powder it is necessary that only a small portion of the solvent remains in the powder. In view hereof it has been found advantageous to employ a volatile acid, for instance a solution of acetic acid, as solvent. Solutions of 1/10 to 1/100 n produce excellent powders, particularly when the gluten solution (the emulsion) is atomized in hot air. A fully satisfactory powder may be obtained when the gluten solution is homogenized by being passed through an ordinary separator of known construction, or by being passed through a tube provided with a rapidly rotating and perforated worm.

The powder produced in accordance with the above described methods possesses highly improved baking properties, and accordingly it may be employed with advantage as an addition to flour. It may likewise be employed in the production of plastic masses, solutions that are to be spun, and the like.

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an amount that a softening of the material to be roasted does not occur up to temperatures of about 1450°C.

There is no hindrance to partly substitute for the ferrophosphorus present in the starting mixture phosphoric acid, alkali-ortho-phosphate, alkali-meta-phosphate or alkali-pyro-phosphate or such salts containing phosphoric acid as are capable of binding the lime which is present in the crude phosphate, but not yet linked to phosphoric acid; such salts are for instance calcium monophosphate or calcium diphosphate.

According to a suitable method of carrying out the process of the invention an intimate mixture of finely ground crude phosphate on the one hand and ferrophosphorus and fine-grained sodium carbonate on the other hand, calculated according to the statements given above, is moistened with water to such an extent that the mass may be agglomerated so as to form small globular lumps of about the size of a pea. This reaction mixture is introduced into the upper, non-heated part of a slightly inclined revolving furnace and slowly conducted towards the fuel which enters from below and is suitably fed with such an excess of air that the escaping gases of combustion still contain about 1 to 2 per cent of oxygen. The temperature in the hottest part of the furnace is at least 1100° C, preferably 1250° C, and must not exceed 1350° C.

By the process of the present invention it is possible to produce from crude phosphate a matter useful as fertilizer simply in one single operation while simultaneously using ferro-phosphorus for which other possibilities of use exist only to a small extent.

The following examples illustrate the invention:

(1.) 2.46 kilos of ferrophosphorus containing 26.5 per cent of phosphorus are mixed with 4 kilos of sodium carbonate and soaked with water. After having added a mixture of 30 grams of finely ground Pebble crude phosphate (32.9 per cent of P_2O_5, 47.9 per cent of CaO, 7.3 per cent of SiO_2, 3.7 per cent of F) and 2 kilos of sodium carbonate the mass is vigorously kneaded. The content of water of the mass is to be so high that the kneaded mixture does not crumble. The mixture thus pre-treated is conducted to a granulation worm from which granulated bodies of a diameter of about 2 to 6 mm are obtained. Without having been previously dried the granulated bodies are then continuously introduced into the upper non-heated end of an inclined. revolving furnace and they gradually reach the hotter zones of the furnace. The revolving furnace is heated by means of fuel gases or burning oils which are blown in at its lower end with such an excess of air that the gas leaving the furnace still contains about 2 per cent of oxygen. The maximum temperature in the furnace amounts to 1250° C. When passing the furnace (50 to 60 minutes of sojourn) the granulated bodies maintain their form and do not tend to adhere at the walling of the furnace. The roasted product consists of

	Per cent
P_2O_5	33.85
CaO	41.20
Na_2O	9.65
Fe_2O_3	7.83
F	0.03
SiO_2	5.71

Residue: various metal oxides contained in the crude phosphate as impurities.

97.6 per cent of the phosphorus pentoxide present are soluble in citric acid, 96.9 per cent are soluble in citrate.

(2.) A mixture of 15 kilos of Pebble phosphate, 15 kilos of Morocco phosphate (34.5 per cent of P_2O_5, 49.6 per cent of CaO, 3.75 per cent of SiO_2 and 4.2 per cent of F), 6 kilos of sodium carbonate and 3.3 kilos of ferrophosphorus (containing 24 per cent of phosphorus and 1.45 per cent of silicon) is pre-treated and roasted as described in Example 1. The product leaving the furnace contains

	Per cent
P_2O_5	34.02
CaO	40.09
Na_2O	9.23
Fe_2O_3	8.67
F	0.05
SiO_2	5.43

Residue: various metal oxides contained in the crude phosphate as impurities.

97.7 per cent of the phosphorus pentoxide are soluble in citric acid, 95.4 per cent are soluble in citrate.

(3.) A mixture of 30 kilos of Morocco phosphate (34.5 per cent of P_2O_5, 49.6 per cent of CaO, 4.2 per cent of F, 3.75 per cent of SiO_2), 6 kilos of sodium carbonate and 5.1 kilos of ferrophosphorus (containing 25.6 per cent of phosphorus and 0.3 per cent of silicon) is treated as described in Example 1. The roasted product consists of

	Per cent
P_2O_5	34.35
CaO	39.50
Na_2O	8.94
Fe_2O_3	11.25
F	0.07
SiO_2	3.51

Residue: various metal oxides present in the crude phosphate as impurities.

98.2 per cent of the phosphorus pentoxide are soluble in citric acid, 95.8 per cent are soluble in citrate.

(4.) 1 kilo of a mixture of equal parts of lime and clay is added to a mixture of 30 kilos of Pebble phosphate (32.5 per cent of P_2O_5, 47.6 per cent of CaO, 7.65 per cent of SiO_2, 3.7 per cent of F) with 5.7 kilos of sodium carbonate and 4.0 kilos of ferrophosphorus (containing 21.88 per cent of phosphorus and 4.81 per cent of silicon) and the whole is treated under the conditions indicated in Example 1. The product leaving the revolving furnace contains

	Per cent
P_2O_5	31.02
CaO	39.78
Na_2O	8.6
Fe_2O_3	10.61
F	0.08
SiO_2	6.85

Residue: various metal oxides present in the crude phosphate as impurities.

96.60 per cent of the phosphorus pentoxide are soluble in citric acid, 94.28 per cent are soluble in citrate.

(5.) A mixture of 25 kilograms of Morocco phosphate (34.5 per cent of P_2O_5, 49.6 per cent of CaO, 4.2 per cent of F, 3.75 per cent of SiO_2) with 4.75 kilograms of ferrophosphorus (containing 21.82 per cent of phosphorus and 3.36 per cent of silicon) and 38.6 kilograms of a spent lye containing 7.4 per cent by weight of Na_2O (in the

form of hydroxide, carbonate, formate, acetate) is treated under the same conditions as those described in Example 1, however, at a maximum temperature of the furnace of 1300° C. The product leaving the revolving furnace consists of

	Per cent
P_2O_5	33.39
CaO	38.40
Na_2O	7.52
Fe_2O_3	13.94
F	0.08
SiO_2	4.16

Residue: various metal oxides present in the crude phosphate as impurities.

95.6 per cent of the phosphorus pentoxide are soluble in citric acid, 94.7 per cent are soluble in citrate.

(6.) A mixture of 20 kilograms of Southern phosphate (32.20 per cent of P_2O_5, 45.32 per cent of CaO, 11.31 per cent of SiO_2, 3.12 per cent of F) with 2.40 kilograms of ferrophosphorus (containing 26.98 per cent of phosphorus), 3.36 kilograms of natural lime, (containing 47.6 per cent of CaO) and 3.16 kilograms of sodium hydroxide is treated as described in Example 1, however at a maximum temperature of the furnace of 1300° C. The roasted product contains

	Per cent
P_2O_5	31.32
CaO	42.25
Na_2O	7.90
Fe_2O_3	7.57
F	0.12
SiO_2	8.95

Residue: various metal oxides present in the crude phosphate as impurities.

94.6 per cent of the phosphorus pentoxide are soluble in citric acid, 92.7 per cent are soluble in citrate.

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PROCESS OF SAVOURING AND FLAVOURING

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The customary processes of impregnating with savouring or flavouring substances victuals and delicacies, cosmetics or pharmaceutical preparations etc., imply considerable disadvantages, partly because such substances will undergo an alteration of their original qualities, partly because they will readily evaporise or be volatilised, or because they are reduced in effect due to other reasons.

The great majority of natural, and a great number of synthetic scenting and aromatising agents will, within the preparations, to which they are intended to impart their scent or aroma, be altered due to the fact that they will adopt, for instance, the scent or aroma characteristic of the component substances of the preparation concerned, e. g. the fatty-acid smell of soap, or the stearic-acid taste of the lubricant used in the manufacture of fruit lozenges, or that they will be influenced by extraneous smells adsorbed by the surface of such components of the preparation concerned, e. g. superficial scents of chalk in the case of tooth-powders, or of bicarbonate of sugar in the case of effervescent powders. They are also liable to be altered by a chemical mutual effect exercised between them and the components of the preparation, (e. g. alkaline substances, acids), or by their catalytic actions, for instance bringing about an oxydising effect.

The savouring and aromatising substances are, moreover, subject to a continuous alteration in strength of their smell or taste, owing to volatilisation or evaporation, which takes place in such a way that, as far as combinations of several substances are concerned, an individual scent will, possibly, be liable to evaporate quicker than others, whereby the composition is due to undergo fundamental alterations.

My present invention refers to a process of impregnating with a scent or aroma the preparations mentioned above, which for instance, are processed either as a powder, or in a highly viscous condition as a paste, and the final condition of which is either solid, semi-solid or liquid, as desired. The main object of the present invention is to prevent the aforementioned difficulties by a novel method. Particularly, the inventions aims not only to protect the savouring and flavouring agents from the influence of agents causing an alteration of the aroma, but also to guard them against any undesired evaporation or volatilisation. To this end, my novel method is based on the measure that the savouring or flavouring substances are stored in a multiplicity of insulating cells, from which they will only be discharged upon the consumption of, for instance, the victuals, cosmetic articles, etc. Such storing is, under the present invention, brought about in such a way that storing substances, containing amicroscopical and non-elastic hollow spaces, within which the either fluid or dissolved savouring and flavouring agents, respectively, have been absorbed, are admixed to the articles to be treated, i. e., for instance, to the soap to be scented, or to a pudding powder.

The inventive method will result in the fact that due to the well known absorbing capacity of certain substances the savouring agents are so to say filled into an extraordinarily great number of extremely small "containers" protecting them from extraneous smells, from chemical influences, from evaporation, etc., the scenting agents, however, being discharged from said containers in their natural and original condition by means of liquids upon their consumption, and only to the extent of the latter, e. g. when preparing a lemonade, when chewing lozenges, when moistening a cake of soap, etc.

A further subject matter of the present invention is, at the same time, also embodied by the storing substances themselves having absorbed the scenting or aromatising substances and which are to be used as intermediate products and can, for instance, be sold as certain standardised quantities of exactly stated equal weight, either as tablets or subdivided in another manner, in order to be used as a preparation for the purpose of aromatising the substances concerned in any individual case.

As storing substances, by which the savouring or flavouring agents are to be absorbed in accordance with my invention, may be used any non-elastic substances provided with a-microscopical hollow spaces, e. g. organic or inorganic jellies ("gel"), jellies of gelatine hardened by means of alcohol, jellies of silicic acid, and furthermore coal of coconut, aluminium oxide, ferrous oxide, zeolites, or the like. Preferably, however, substances will be selected for this purpose, which contain capillary vessels of such size as will enable the reduction of the steam pressure, whereby the evaporation of the aromatising substances will be restrained. Whereas, as a rule, such storing substances are concerned for practising the process under this invention, as possess capillaries having a radius of about 1 to $60\mu\mu$, the substances bringing about a reduced steam pressure are chiefly such as are provided with capillary tubes having a semi-diameter of

less than $50\mu\mu$. As a matter of course the diameter of the capillary vessels and also the proportion of space occupied by capillaries of a certain size as compared with the space occupied by all of its capillary hollow spaces will also vary in the case of every individual substance, wherefore in every individual case the suitability of a substance will have to be ascertained by way of experiments.

A report on the process of reduction in vapor pressure, which is to be made use of under the present invention, has, for instance, been published by W. Bachmann; see his article entitled: "Über die Dampfspannungsisothermen von Körpern in Gelstruktur" (on the vapor-pressure isotherms of substances showing the structure of jellies) in the periodical "Anorganische und allgemeine Chemie", Volume 100, p. 9. Information as to the manner in which the radius of capillary vessels can be ascertained, is given by I. S. Anderson in "Zeitschrift für physikalische Chemie", Volume 88, pages 191 to 228.

The savouring and flavouring agents, as far as they are liquids, will be directly absorbed by the capillary vessels of the storing substances, whereas solid storing substances are to be used in solvents. In such cases between 2 and 100 percent, and even more, of the savouring and flavouring agents will, corresponding to the specific weight of the aromatising and of the storing substances concerned, be absorbed by the storing substances, stored by the latter within their capillaries, and thus be protected from the influence exercised by other substances.

It is not absolutely necessary that the savouring and flavouring agents are always absorbed by a storing substance which is a powder; they can also be embedded into a granulated storing substance which is thereafter ground, if required so. Under certain conditions it may, however, also be desirable to impregnate the storing substance, when not yet disintegrated, and thereafter to leave it in its undisintegrated condition; e. g. in the case of gelatine foils hardened with alcohol, which have been impregnated with a fruit aroma.

The storing substances are advantageously used in a most finely dispersed, precipitated, sprayed or ground condition, in which they are almost unpalpable, e. g. when rubbing them between the finger tips, (so-called unpalpably fine powders). In such a condition the storing substances which must be capable of being wetted by the individual savouring or flavouring agent concerned, are, for instance, sprinkled with the latter; the storing substances are, in doing so, to be thoroughly mixed, in order to offer always new particles capable to absorb them, to the liquid. It would also be possible to oversaturate only a portion of the storing substance with the scenting or aromatising agent, and thereafter to mix it with untreated storing substance.

When practising the process under this invention, scenting and aromatising substances of any degree of solubility whatsoever, can be used together with the solvents adequate to them, for instance substances which are soluble in fat or in water. When selecting the storing substances absorbing them, care must only be taken that the above mentioned capability of being wetted, is present. The proportion of weight existing between the scenting and aromatising substances, respectively, and the storing substance, will, as an average, be about 1:2 to 1:35.

A further development of the inventive idea is based on the fact that there exist flavouring and savouring substances, which are extremely delicate, wherefore they will render certain precautionary measures indispensable, in particular with due regard to the risk that they might be impaired by extraneous scents or by catalytic effects emanating from the storing substance.

Substances having a large surface area will be inclined to adsorb or absorb smells, humidity, etc., with a comparatively great readiness. Therefore storing substances offering a high degree of purity and not possessing any particular smell of their own, will principally be selected for the process under this invention. In doing so, the storing substances may, in accordance with one manner of practising the invention, prior to impregnating them, be freed from any traces of extraneous smells adopted, or of such undesirable substances, as are due to the manufacturing process, if any, such purification being carried out by washing the storing substances with water, alcohol or other solvents. The powders purified in this manner, must be carefully dried prior to being used.

Another possibility of eliminating unwelcome influences of the storing substances upon the savouring and flavouring agents, consists in evacuating the storing substances prior to impregnating them, (upon heating them at the same time, if appropriate) and in charging them with an inert gas, e. g. nitrogen. It would also be possible to render the storing substances, prior to impregnating them, inactive against catlytic effects by treating them, for instance, with paraffin, wax, resins, or the like solutions or vapours, or with polyvalent alcohols, in order to poison the catalyser. In order to give an example, it would thus be possible to saturate the storing substance with a 0,1% paraffin solution, and after evaporation of the solvent to charge it with the savouring or flavouring substance.

Finally the savouring and flavouring substances can also be protected from the catalytic influences by storing them, after they have been mixed with white paraffin-oil, glycerin, resins, waxes or another liquid or solution by nature, acting as a poison upon catalysers.

On the other hand, however, experiments also show that there are cases, where it is possibly desirable to exercise a certain catalytic effect upon the savouring or flavouring substances by means of the storing substance. There are, for instance, inferior Spanish Lavender oils, the aroma of which will be mellowed, when they are stored within storing substances exercising a catalytic influence.

Several examples, showing, in what manner the process under the present invention can be practised, are set forth below.

(1) *Shredded soap.*

In a vessel which can be heated and is provided with an agitator and with devices for expelling the air from it, 2 kg of finely powdered silicic acid jelly are placed, whereupon the vessel is closed and the expulsion of water from the powder is carried out, heat at the same time being admitted. After this process has been finished, the powder is cooled down in vacuo.

Thereupon, availing oneself of the difference in pressure, existing between the internal and the external pressure, 500 g of an essential oil, e. g. Lavender oil or mixtures of such oils, e. g a mixture of neroli-, lavender, bergamot-, geranium- and lemon-oil, is fed to the agitated powder by spraying it through a distributor, when the agi-

tator is working, said spray being absorbed by the powder upon discontinuance of the vacuum.

Either in the same or in a separate container 50 kg of a well dried and ground or sliced primary soap provided with a soap colouring substance are mixed with the powder of silicic acid jelly in such a way that the additions are as evenly distributed as feasible. The mixture is then spread in the well known manner by means of rollers, whereupon it is fed to a bar extruding press. The cakes of soap are finally formed by means of a striking press.

(2) Effervescing lemonade powder

In order to prepare a primary aroma substance for effervescent lemonade powder, a gelatine hardened with alcohol and having pores with a semi-diameter below 50$\eta\eta$ as an average is to be selected.

After having powdered and evacuated the gelatine, it is to be perfectly saturated with nitrogen, whereupon, for instance, lemon oil is to be absorbed by it at a proportion of 1:4 by weight.

About 0.6 g of this powder are mixed with
800.0 g of sugar,
100.0 g of sodium-bicarbonate, and
100.0 g of tartaric acid.

(3) Peppermint lozenges

A primary aroma substance of powdered jelly of gelatine hardened with alcohol and of peppermint oil at a proportion of 1:9 by weight is prepared.

Furthermore 1000 g of sugar are mixed with

	Grams
Water	50
Glucose	100

the mixed substance then, upon stirring it, being dried in a flat vessel, which can be heated. Thereafter 1.8 g of the Peppermint powder are added thereto.

After Talcum has been admixed, the substance is thoroughly mixed and lozenges made of it by pressing.

(4) Pudding powder

Raspberry essence is to be absorbed by gelatine hardened with alcohol at a rate of 1:10 by weight. This powder is thereupon mixed with castor sugar at a proportion of 1:9 by weight, and a colouring substance is added.

(5) Salt of bittern

Lavender oil is mixed with glycerine at a proportion of 10:1 by weight. This mixture is then to be absorbed by an extremely fine powder of aluminum-oxide jelly. Thereafter the powder is mixed with bicarbonate of sodium or coloured sodium-sulphate at a rate of 1:60 by weight, whereupon tablets are formed by pressure, or the mixture is filled into bottles as a loose powder.

(6) Taste-correcting agent for pharmaceutical preparations

Powdered coconut charcoal is saturated with 0.1% alcoholic solution of benzoic resin.

After evaporation of the solvent has taken place, aniseed-oil is caused to be absorbed by the coal treated in this manner at a rate of 1:4 by weight.

So much of this powder is added to a dry extract of pancreas, that the individual aroma of the pancreas-taste will be hidden thereby. Tablets are made of this mixture, availing oneself for the pressing operation of the customary admixtures and lubricants.

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ALIEN PROPERTY CUSTODIAN

TRANSMISSION DEVICES

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The present invention relates to systems for transmitting torques from a driving mechanism to a driven mechanism, and it is more especially, although not exclusively concerned with systems of this type including change speed devices of the continuous or gradual type.

The chief object of the present invention is to provide a system of this type which is better adapted to meet the requirements of practice than those used for the same purpose up to the present time and in particular which is capable, when starting from a given driving mechanism, to increase the range of torques and speeds which can be obtained for the receiver mechanism, account being taken of the mechanical characteristics of the transmission.

According to the essential characteristic of the present invention, the system includes at least two shafts or transmissions capable of transmitting the driving efforts, with certain torque or speed characteristics which are variable (at least for one of these two factors) within certain limits, and coupling means, interposed between these transmissions and a receiver shaft or other element, for receiving movement either from only one of these transmissions, transforming said movement, and applying it to the receiver shaft with characteristics different from the initial characteristics of this movement, in particular with higher torques, or from both of these transmissions when the conditions of operation make it possible without the torques which are then applied exceeding the values that can be supported by said transmissions.

Other features of the present invention will result from the following detailed description of some specific embodiments thereof.

Preferred embodiments of the present invention will be hereinafter described with reference to the accompanying drawings, given merely by way of example, and in which:

Fig. 1 is a plan view, partly in section, through the driving and receiver shafts, of a system including a driving source of power and a transmission device according to the invention for transmitting movements, with a range of variable speeds and torques, to a receiver shaft, this system being made according to a first embodiment;

Fig. 2 is a sectional view on the line II—II of Fig. 1;

Fig. 3 is a sectional view on the line III—III of Fig. 1;

Fig. 4 is a diagrammatic side view corresponding to Fig. 1, the gears being shown merely by their pitch circles;

Fig. 5 is a plan view, partly in section, of a transmission system according to the invention made according to another embodiment;

Fig. 6 is a partial section on the line VI—VI of Fig. 5;

Fig. 7 is a diagrammatic side view corresponding to Figs. 5 and 6;

Fig. 8 is a plan view, partly in section, of a system of the type of that of Fig. 1, made according to another embodiment;

Fig. 9 is a plan view, similar to Fig. 8, showing still another embodiment;

Fig. 10 is a plan view, partly in section, of a transmission system made according to a modification of the embodiments illustrated by the above mentioned Figs.

Fig. 11 is an elevational view of the essential elements of a change speed device of the continuous type adapted to be applied, according to the invention, to the transmissions which constitute the chief object of the invention;

Fig. 12 shows a transmission system, also made according to the invention, including several electric motors;

Fig. 13 is an axial sectional view of a device of the kind of that diagrammatically shown by Fig. 12;

Fig. 14 is a diagrammatical view illustrating a detail of the device of Fig. 13;

Fig. 15 is a view, similar to Fig. 13, showing still another embodiment;

Fig. 16 is a diagrammatical view illustrating a detail of the device of Fig. 15.

The invention is intended to provide means for transmitting a driving power to a receiver shaft with variable torques and speeds.

For the sake of clarity we will first consider the case in which the motive power is supplied by engines adapted to run within determined ranges of speed, with torques variable within restricted limits, which is the case of explosion or internal combustion engines. As a matter of fact, it will result from the following description that the choice of this particular case has no limitative character.

It is known that the solutions that have been proposed for obtaining a variable torque and ratio transmission generally consisted in making use of change speed devices of either of the two following types:

a. The non-continuous type, giving a limited number of gear ratios;

b. The continuous type, or gradual type, which

is to permit of obtaining, on the receiver shaft, speeds varying in a continuous manner from zero (at least theoretically) to a maximum.

In particular, when it is desired to obtain very important torques, for instance in the case of motor vehicles to be started under considerable load (lorries, automotive or other railroad vehicles, and the like) the above mentioned solutions are insufficient. The first of these solutions calls for a very great number of different ratios of transmissions, which involves mechanisms which are very cumbersome and necessitate complicated maneuvers. The second solution permits only theoretically of obtaining zero speed on the receiver shaft (which would correspond to torques of unlimited values) because the elements of these gradual working change speed devices can, for a given volume of the whole mechanism, work correctly only for torques lower than a limit value.

It has also been proposed, in order to increase the starting torques by reducing the speed, to interpose, between the driving shaft and the final receiver element, not only a change speed box, but also a fixed speed reducing gear. However, it is clear that such a mechanism merely displaces the range of speeds that is obtained, without modifying the width thereof.

In order to meet the requirements of practice, and in particular, in order to obtain both very high torques when starting and a speed as high as possible when working under normal conditions, we proceed in the following manner according to the invention:

The driving force is transmitted to at least two primary receiver shafts or equivalent transmission means, with given torque and speed characteristics which, for at least one of said shafts, can be varied within predetermined limits (either by varying one of the torque and speed factors, or by varying both of them simultaneously).

Furthermore, between said primary receiver shafts and the final receiver shaft or output shaft, we interpose a coupling device capable either of receiving movement from only one of the primary shafts and transforming it to apply it to the output shaft with characteristics different from the input characteristics (and in particular with higher torques), or of receiving movement from both of said shafts when the working conditions, account being taken of the resistant torque, are or become such that the torques applied to the primary shafts do not exceed the values that can be transmitted by said shafts without danger of breaking.

Such a system permits, as it will be hereinafter explained, of multiplying the torque on the final receiver shaft while reducing in the same proportion its minimum speed, and this without involving a corresponding reduction of the maximum speed of said output shaft.

In Fig. 1, we have diagrammatically shown a device according to an embodiment of the present invention, which can be adopted and is supposed to be applied to the case in which a motor M drives, through change speed devices or gear boxes H^1 and H^2, for instance of the gradual type, two primary shafts 1^1 and 1^2, which are connected to the output shaft 2 through the above mentioned coupling system.

This last mentioned system can be made in many different ways, preferably consisting of a mechanism of the sun-and-planet wheel type. This mechanism may be an epicycloidal gear, or, as shown by the drawing, a hypocycloidal gear, and it includes the following elements:

a. A small sun wheel 3, which is actuated by shaft 1^1;

b. A set of planet wheels 4, carried by the receiver shaft 2; and

c. A big sun-wheel 5, consisting for instance of a kind of box or drum and adapted, under some conditions, to be driven by shaft 1^2, through any suitable transmission means, illustrated by the drawing (Figs. 1 and 4) in the form of a chain 6 coacting with pinions 7, 8 (the ratio of transmission of these means being either fixed or variable and being supposed, on the drawing, to be equal to 1.

Such a system might be arranged in a different manner. For instance, in the embodiment illustrated by Fig. 10, the big sun-wheel transmits the movement, through means 9, 10, to the output shaft, whereas the planet-wheels can be connected to the second primary shaft 1^2, in particular through gears 11, 12.

This system, made according to either of the two embodiments above mentioned or according to any other equivalent embodiment, permits of obtaining the following results:

On the one hand, it reduces the speed of the movement applied, with a torque C^1, to pinion 3 by primary shaft 1^1, and, consequently, it multiplies, proportionally, the torque C^2 applied by the planet wheels to the output shaft (Fig. 4), or by the big sun wheel, (Fig. 10).

On the other hand, it makes it possible to bring into play, at the proper time, primary shaft 1^2, in order to multiply the speed, transmission 6, 7, 8 being such that the big sun wheel is driven in the example illustrated in the same direction as the small sun wheel, so that it is possible, when the speeds of the two sun-wheels come to be equal to each other, of obtaining a kind of direct drive between the two primary wheels 1^1, 1^2.

It will be noted that, in the drive of the above mentioned epicycloidal gear by the primary shaft 1^2, the resistant torque applied thereto by said gear is equal to torque C^3 (Fig. 4) or to torque C^2 (Fig. 10). In view of the importance of this torque, the value of which, especially during the starting period, can exceed the limit that can be supported by shaft 1^2, we provide means for bringing this last mentioned shaft out of action and releasing it from the action of said torque. These means consist, for instance, in the combination with the transmission gear of a free wheel device such as 13, 14 coacting with the big sun wheel (Figs. 1 and 2) or with the set of planet wheels (Fig. 10).

Therefore, it is that last mentioned device that will support torques C^2 or C^3 for the time during which said torques have very high values corresponding for instance to the starting periods of the whole. It will be readily understood that these values can be as high as it may be desired, since the reactions on device 13, 14 are static reactions and are applied to frame 25. The values of these torques are limited merely by the characteristics of shaft 1^1, account being taken of the ratio of transmission or gear ratio of mechanism 3—4.

The operation of the whole of the transmission system according to the invention includes two successive steps, to wit:

a. A first step, used, in particular, for starting the device, during which the speeds and the torques of the output shaft, result from the combination of the first change speed device H^1,

shaft 1^1, and the speed reducing gear constituted by gear mechanism 3—4.

b. A second step, which begins when the resistant torque applied to device 13—14 drops below a value that can be supported by shaft 1^2, during which step it is possible to pass into higher and higher gear up to a maximum corresponding to the combination of the two maximum ratios of devices H^1 and H^2, respectively (which ratios may be equal).

In order to increase safety, we may provide, on the primary shafts, free-wheel devices such as 16, 17 or the like (Figs. 1 and 3) which, in the case of too high a resistant torque being applied to the output shaft 2, transmit the reactions directly to frame 15.

It should be well understood that any suitable means may be provided for ensuring, under correct conditions, the passage from the first step to the second step, or inversely.

For instance, these means may act to lock the means for controlling the working of the second primary shaft 1^2, or the gear box H^1 associated therewith, or to prevent the action of the corresponding source of motive energy, when torque C^2 or C^3 is too high.

The above mentioned means may also act to bring the second shaft 1^2 automatically into or out of action.

Said means may be made and operated in many different ways. Merely by way of example, it has been supposed, on the drawing (Figs. 1 and 2) that said means make use of the reaction applied to free-wheel device 13, 14. This reaction, measured by a dynamo-metric device 18, is transmitted, for instance through hydraulic means, associated with a conduit 19 and a membrane 20, to a device 21 for locking lever 21^2, through which gear box H^2 is operated. In this way, during the starting period, this lever cannot be displaced until the other gear box lever 21^1 has been operated and torque C^2 or C^3 has dropped below a suitable value.

Any other mechanical, pneumatic, or electric control devices may be employed for the same purpose.

It has been supposed, in the preceding description, that two primary shafts were employed, but it is clear that we might make use of a greater number of primary shafts. We have shown, by way of example, in Figs. 5 to 7 inclusive, a transmission system including three shafts 1^1, 1^2, 1^3, working in series, with two sun-and-planet gears. The first of these gears transmits movement to an intermediate receiver shaft 2^1 which plays, with respect to the second sun-and-planet gear, the same part as the primary shaft 1^2 with respect to the first.

The second sun-and-planet gear has been illustrated as being of the type including two pinions 4 and 4^1 for each planet wheel, which makes it possible of obtaining a high ratio of speed reduction.

With such an arrangement, or with any other equivalent one, we obtain a system which permits of multiplying considerably, on the one hand the range of speeds, and this without changing the maximum speed, and, on the other hand, the range of torques, in view of the mechanical resistance of the parts. In order fully to set forth the advantage of the invention, we will give some numeric examples reltaing to the case, above considered, of a motor coupled to two, or more, primary shafts.

First example

It will be supposed that two primary shafts are provided and that the torques they are capable of supporting vary in a ratio of 4 to 1, for instance from 40 kgs to 10 kgs, for a range of corresponding speeds from 250 revolutions per minute to 1,000 revolutions per minute. On the other hand, the epicycloidal gear is chosen with a ratio of $4/1+1$. In other words, when the big sun wheel is stopped, the set of planet wheels turns with a speed which is $1/5$ of the speed of the small sun wheel.

Under these conditions, the torque C^2 that is applied to the output shaft (Fig. 4) is equal to 5 times the torque C^1 applied to the small sun-wheel. As for the reaction C^3 on the big sun-wheel, it is equal to four times C^1.

Considering first shaft 1^1 when its torque is maximum (40 kgs) and its speed is minimum (250 revolutions), it will be seen that, owing to the epicycloidal gear, the output shaft 2 can receive: a torque of 40×5, that is to say 200 kgs.; and a speed of 250/5, that is to say 50 revolutions.

These conditions correspond to transferring to the big sun wheel a torque of 4×40, that is to say 160 kgs, which could not be accepted for shaft 1^2, but free wheel device 13—14 acts in this case for transmitting this torque directly to frame 15.

This is the first step of operation, during which it is possible, by acting on the gear ratio of gear box H^1, of causing the speed of output shaft 2 to pass from 50 revolutions to 200 revolutions.

At this time, primary shaft 1^1 turns at a speed of 1000 revolutions per minute and supports a torque of 10 kgs. It follows that the big sun-wheel transmits a reaction of 10×4, that is to say 40, kgs. Now, this is the limit value of the torque that can be supported by primary shaft 1^2.

The second gear box H^2 can be brought into action for gradually increasing the speed of shaft 1^2. When this speed has reached its maximum value, that is say 1000 revolutions, and supposing that the ratio of transmission between said shaft and the big sun-wheel is equal to 1, the speeds of the two sun-wheels are equal to each other, and also to the speed of the receiver shaft, to wit 1000 revolutions per minute.

Finally, the torques will have varied from 200 to 10 kgs, that is to say in the proportion of 20 to 1, while the initial proportion was merely 4 to 1. Also, the range of speeds will have varied from 50 to 1000 revolutions per minute, while originally it varied merely from 250 to 1000.

Besides, it should be noted that this increase of the ranges of the torques and of the speeds does not call for any interruption in the transmission.

Furthermore, it is important to note that the operation above described corresponds only to an example. We might also provide for the stopping of the small sun-wheel from the time when the big sun-wheel is brought into play, after which it would be again brought into action, when the big sun-wheel reaches its maximum value. With such an arrangement, we would obtain a slightly different range of speeds.

Also, it is clear that we might provide speed reducing or speed multiplying gears between the big sun-wheel and shaft 1^2. Anyway, the maximum ratio to be provided between the small sun-wheel and the big sun-wheel would be the ratio

of the maximum torque and the minimum torque that can be transmitted by each of the shafts.

The above calculations would apply to the case of more than two shafts, as illustrated by way of example by Figs. 5 to 7. Supposing for instance that the torques and the speeds of shafts 1^1, 1^2, 1^3 in the case of three shafts, are the same as those above mentioned, it will be seen that the intermediate receiver shaft 2^1, on the output side of the first epicycloidal gear, can transmit torques from 10 kgs to 200 kgs. It follows that we may chooose, for the second epicycloidal gear, a ratio of $^{200}/_{10}+1$, that is to say 21. Under these conditions, the final receiver shaft is capable of transmitting a torque of 40×20, that is to say 840 kgs. The full range of torques, for the whole of the transmission, will therefore go from 10 to 840 kgs, and the range of speeds will go from $^1/_4$ to $^1/_{84}$, still without interruption in the transmissions and without the maximum speed being influenced.

Concerning the means for obtaining the transformation of the speeds between the source of energy and the primary shafts 1^1, 1^2, etc., they can be made in any suitable manner, being, at will, of mechanical, electrical, hydraulic, or any other nature.

Eventually, clutches, such as shown at **22** by Fig. 8, may be provided, these clutches being themselves of mechanical, hydraulic or any other suitable value.

When mechanical change speed devices are utilized, they may, for instance, be of the pulley and friction type as shown at **23—24** in Figs. 8 and 9, these devices being actuated from a driving shaft **25**.

However, advantageously, we make use of change speed devices of the connecting rod type, and, more especially, of the change speed devices described in the Belgian patent No. 412,795, filed Dec. 14, 1935.

We will now give a second numerical example corresponding to this application.

Second example

The change speed devices of the type above described essentially include, as shown by Fig. 11, a plurality of sets of connecting rods or arms **26, 27, 28, 29**, for instance four, actuated by the crank pins, placed at suitable angles with respect to one another, of a crankshaft **25** which drives the mechanism. Each set of arms acts on the receiver shaft through a free wheel device **30, 31, 32**, for instance of the type in which two surfaces **30** and **31** roll on each other, with a wedge **32** interposed between them and adapted to prevent rolling in one direction.

Therefore, if there are two receiver shafts, use is made of two series of four sets of arms as above described which, preferably, according to an arrangement set forth in a patent application filed at the same time as that above mentioned, are mounted on the same crankshaft **25**, each crank pin of the latter acting on two connecting rods **26**, etc. belonging respectively to said sets.

The speed variation is obtained by displacing the pivots **33** of the coupling crank **27**, which pivots are for instance guided circularly by means of levers **34**. Supposing that the variation is obtained manually, the two hand levers 21^1 and 21^2 of Fig. 1 would serve to operate separately the pivots **33** of the two sets of connecting rods.

With such an arrangement, and supposing for instance that, on the one hand, the free-wheel devices of the two speed reducing sets are capable of supporting each, dynamically, 400 kgs, and that, on the other hand, motor M develops 40 HP at a speed of revolution of 1440 revolutions per minute, which corresponds to a driving torque of 20 kgs, it will be seen that the maximum speed reduction, under full power is, for each receiver shaft 1^1 or 1^2, $^{20}/_{400}$, or $^1/_{20}$, or 0.05.

As, in connecting rod systems of the kind in question, the highest speed of the receiver shaft is generally, for instance, 0.4 times the motive speed, it will be seen that the range of speeds goes from $1{,}440\times0.4$ to $1{,}440\times0.05$, that is to say from 576 revolutions to 72 revolutions.

Therefore, if shafts 1^1 and 1^2 were merely directly coupled together, we could transmit to the output shaft **2** a maximum torque of 800 kgs (2×400) with said range of speed (from a minimum value to 8 times said minimum value).

If now use is made of an epicycloidal train as above described, with a ratio of $^8/_1+1$ ($^1/_8$ of revolution of the planet wheels for one revolution of the small sun-wheel) it is found that the range of speeds which can be obtained in two successive steps, as above explained, is nine times greater (that is to say from 576 revolutions to 8 revolutions), the maximum torque that can be transmissed to the output shaft **2** being itself 400×9, that is to say 3,600 kgs.

The above examples have been given merely by way of example, and, in a general manner, the invention would apply to any combination of the kind above described, provided between at least two primary shafts, for which:

1. Supposing that their torques would be equal, unequal or variable, their respective speeds would be:

a. Either equal and constant;
b. Or different and constant;
c. Or variable for only one of the shafts;
d. Or variable for more than one shaft;
e. Or variable for all the shafts; and,

2. Supposing that their speeds are equal, unequal or variable, their torques would be:

a. Either equal and constant;
b. Or different and constant;
c. Or variable for only one of the shafts;
d. Or variable for one of the shafts only;
e. Or variable for all the shafts.

On the other hand, it should be well understood that, in order to transmit to shafts 1^1, 1^2, etc. said torques and speeds, we may have recourse to the following means:

1. As above supposed, the combination of at least one source of energy (internal combustion engine, steam engine, electric motor, hydraulic motor, etc.) and change speed devices or intermediate receivers themselves of any suitable type (mechanical, electrical, hydraulic, or other devices);

2. Or directly one or several sources of energy of any type whatever;

3. Or the combination of the two above mentioned arrangements, one of the primary shafts being for instance driven by an engine, and the other by an intermediate receiver which is actuated either by the same engine or by another engine.

In any case, the systems according to the invention make it possible, whenever it is necessary, to absorb the reactions independently of the organs placed before the sun-and-planet wheel gears or the like.

In the following description, we will now give examples of devices according to the invention

in which shafts 1^1, 1^2, etc. are actuated by electrical driving means.

Supposing first the case of two electric motors M^1 and M^2, which drive primary shafts 1^1 and 1^2 at substantially constant speed V, with torques of utilization varying from 10 to 40 kgs, this last mentioned value corresponding to the starting torque, we may make use of the arrangement illustrated by Fig. 12.

If both shafts were merely coupled together, we would obtain merely a maximum torque of 80 kgs, but with a single starting speed.

With the arrangement according to the present invention, for instance with a gear train the ratio of which is $4/1+1$, we obtain two starting speeds with a maximum torque of 200 kgs.

As a matter of fact, by first starting the first motor, which acts on the small sun-wheel, we obtain a first speed V/5 with a torque, on the output shaft 2, of 40×5 that is to say 200 kgs, the reaction of the big sun-wheel being supported by the frame.

Then, when the plant has started and the torque developed by the first motor has dropped down to 10 kgs, the torque on the output shaft 2 is 50 kgs and the reaction on the big sun-wheel is 40 kgs. It is then possible to bring the second motor into play.

The control of this second motor, if it is effected automatically, may, in particular, be obtained through purely electrical means. It suffices, for this purpose, to have recourse to a relay 35 operated in accordance with the current flowing through the first motor. When the current drops below a certain value, this relay starts the second motor by means of a contactor 36.

What has just been told would of course apply to electric motors of different characteristics, for instance:

a. To a motor having a certain speed V, with a minimum torque of 10 kgs and a maximum torque of 40 kgs; and

b. To a motor having a speed V equal or different, with a minimum torque of 5 kgs and a maximum torque of 40 kgs.

By causing, for instance, the small sun-wheel to be driven by the smaller motor and choosing, for instance, for the sun-and-planet wheel gear, a ratio equal to $8/1+1$, the starting torque would be 20×9 that is to say 180 kgs.

When this motor will have reached its normal working speed of revolution with a torque of 5 kgs, the reaction on the big sun-wheel will be 5×8, that is to say 40 kgs, that is to say the maximum torque of the second motor, which can then be brought into action.

Figs. 13 to 16 show another arrangement of the invention, in which the primary shafts are concentric, this arrangement being supposed to be applied to the case of an electric drive.

In the embodiment of Figs. 13 and 14, we provide two electric motors, which are arranged tandem-like, and the rotors of which act respectively on the two shafts 1^1 and 1^2.

Fig. 14 diagrammatically shows the free-wheel devices 13—14 and 16—17 associated with such a system.

In the embodiment illustrated by Fig. 15, a single electric motor is provided, the rotor R and the stator S of which are adapted to act respectively on the two above mentioned shafts, the whole working for instance in the following manner, in combination with the two free-wheel devices 13, 14 and 16, 17 shown in detail by Fig. 16.

Through the medium of a switch, current is distributed in such manner that the rotor first turns in the direction of the simple arrow (Fig. 16). The rotor is then free to turn and the reaction is supported by the free-wheel device 13—14, which coacts with the big sun wheel. With this manner of operating, we obtain a first speed of shaft 2.

When the maximum speed has been reached, the direction of working of the motor is reversed, which causes the rotor to stop in view of the action of free-wheel device 16—17. The stator then starts turning and produces, through the working of the mechanism, a second speed of shaft 2 which is slightly lower than that of the motor, in a proportion which depends upon the characteristics of the epicycloidal gear.

In any case, whatever be the particular embodiment that is chosen, it is possible, according to the present invention, to transmit energy with a range as wide as possible both as to the torque and the speed of the output shaft or shafts.

It will be readily understood that such an invention can be given many different applications and that it will be particularly interesting when the inertia per HP, that is to say the weight that is to be moved, in the case of vehicles, is of high value, or again when the starting torques are of considerable value as compared to the normal working torques.

For instance, in particular, the invention is especially well adapted to the traction of vehicles, either road vehicles or track vehicles, such for instance as railroad automotive cars.

In all cases, it will be possible to obtain the desired starting torque, without the maximum speed of the vehicle being reduced, and without requiring the use of gear-wheel speed reducing gears, the operation of which is always complicated because of the synchronism which is to be obtained in their case between their operation, that of the clutch and that of the engine.

It should further be noted that, in all the cases in which a disengagement of cooperating gears or clutches is to take place under load, the invention has another advantage, to wit the power to be disengaged is lower, since it is possible to act only on one of the primary shafts, that is to say on a load which is only a portion of the load acting upon the final receiver shaft.

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BY A. P. C.

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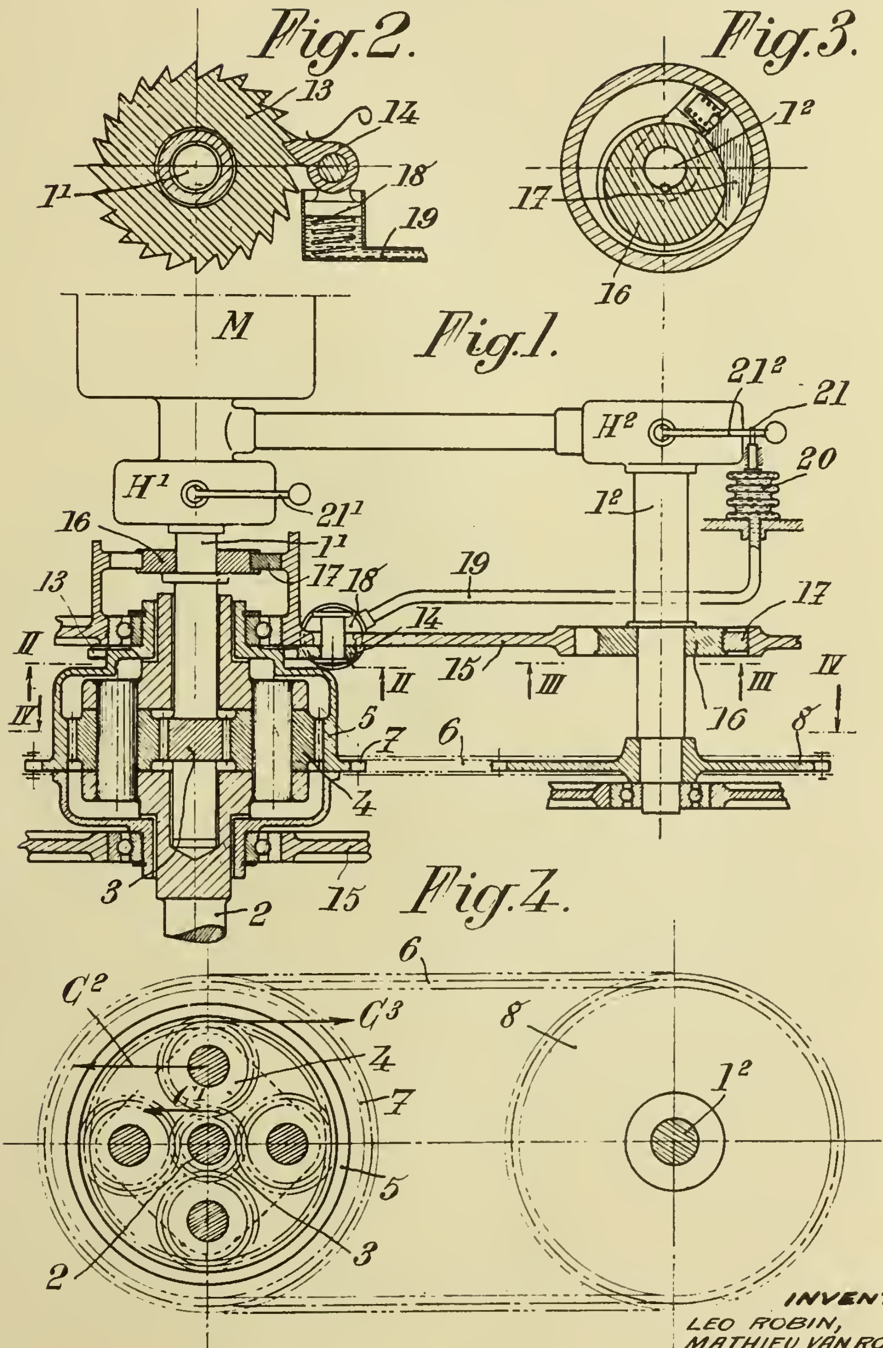

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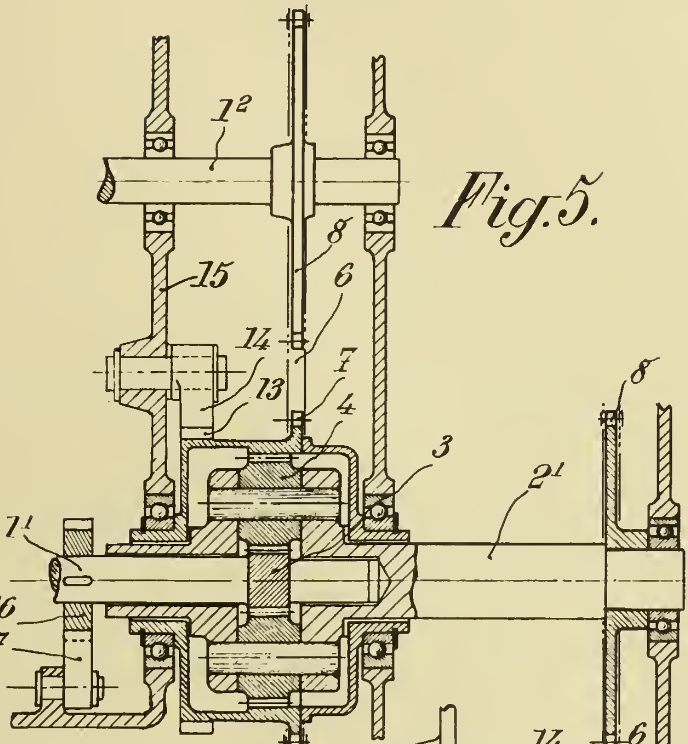

Fig.5.

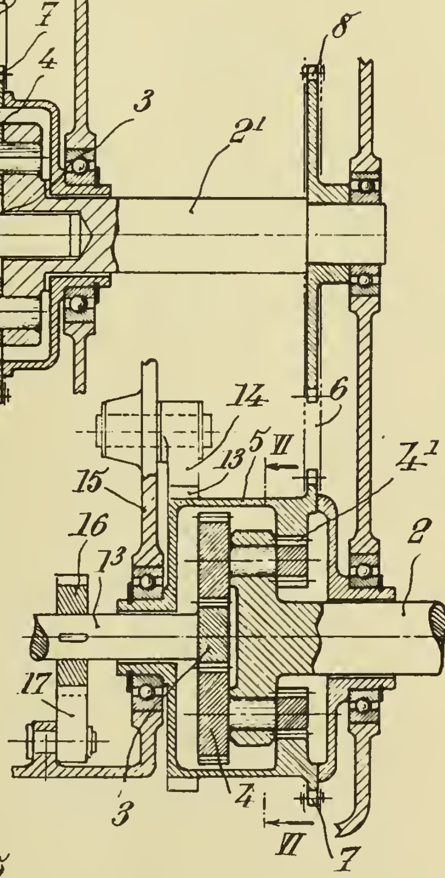

Fig.6.

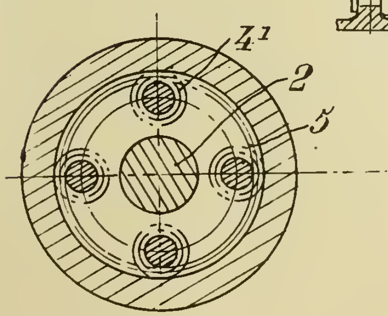

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Fig. 7.

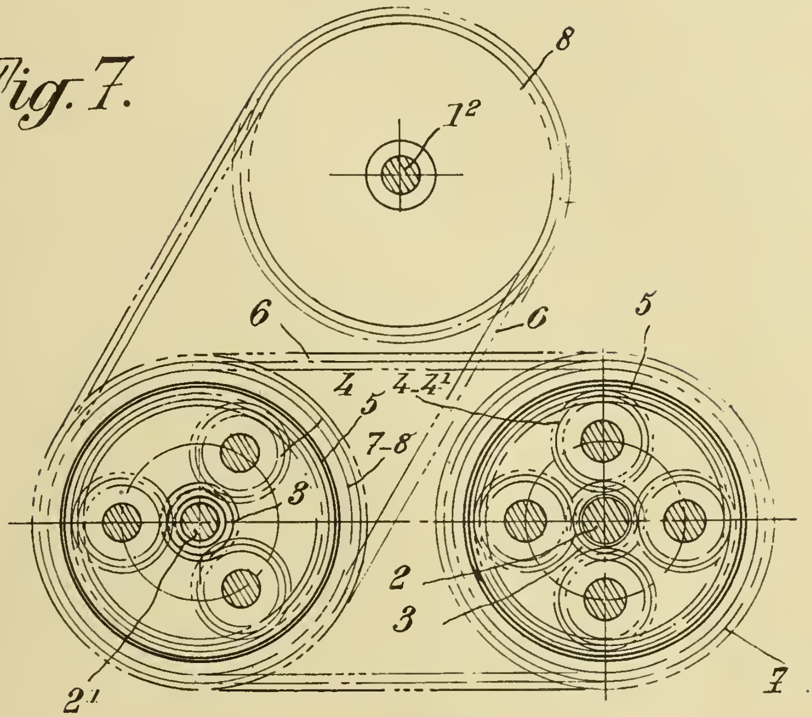

Fig. 10.

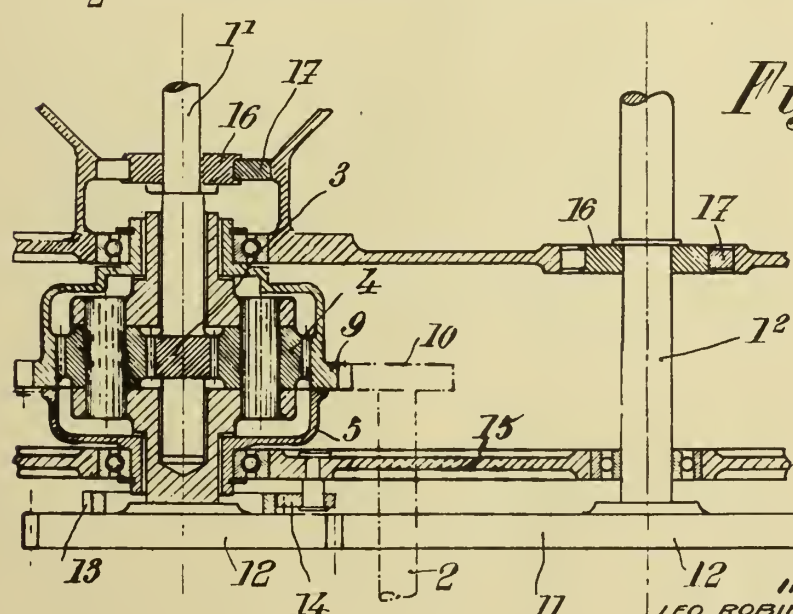

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Fig.8.

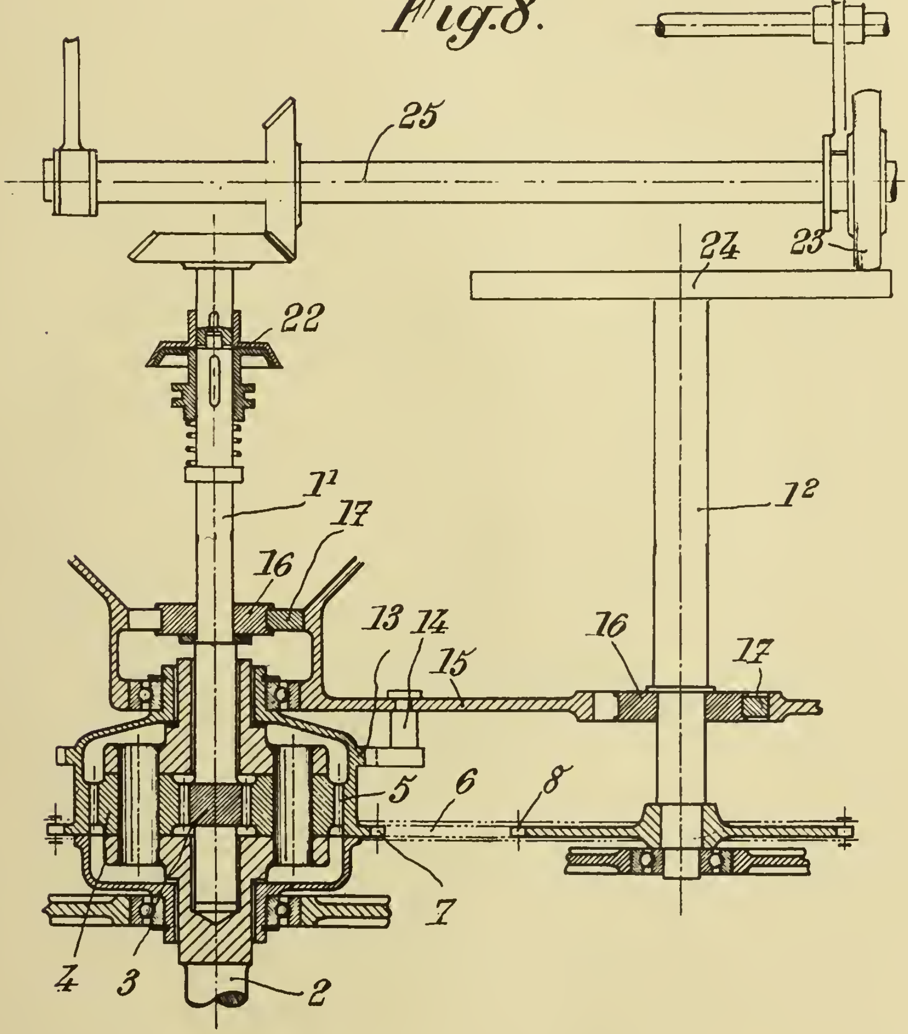

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Fig. 9.

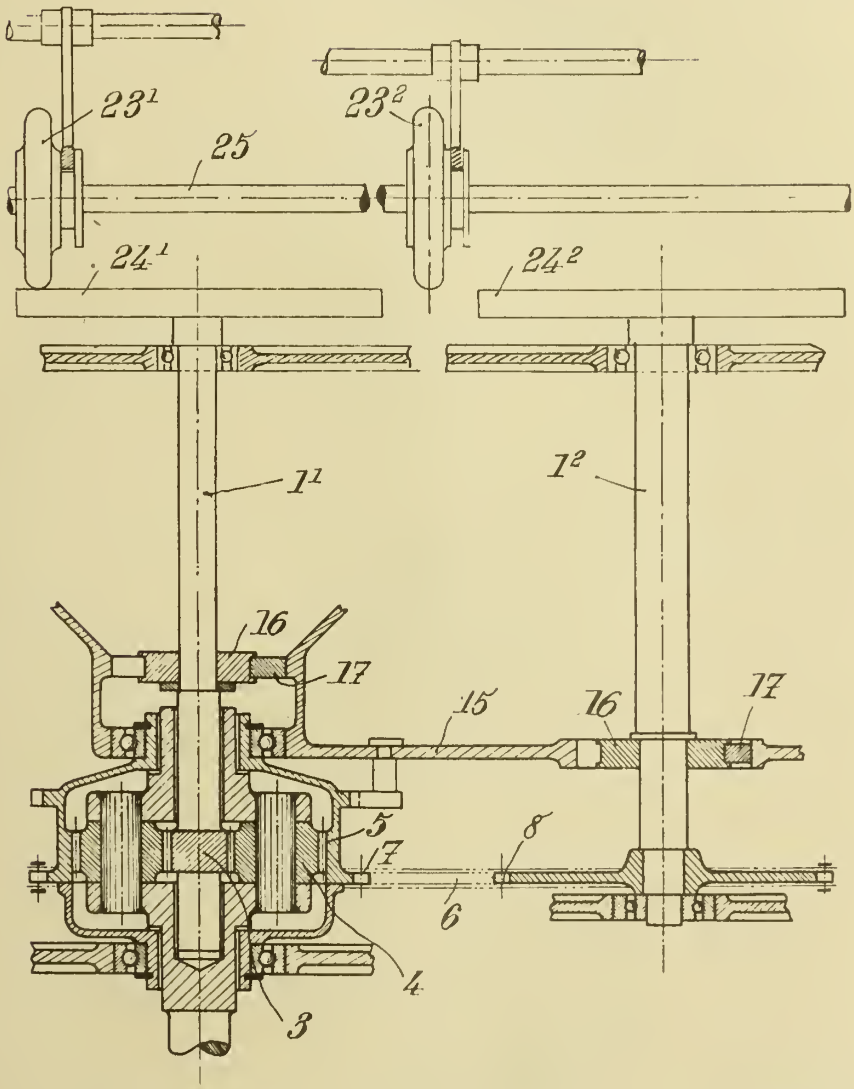

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Fig. 11.

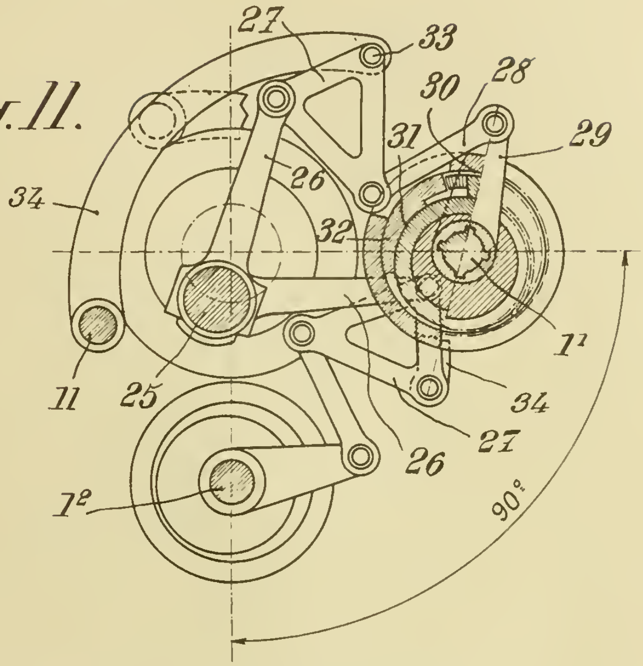

Fig. 12.

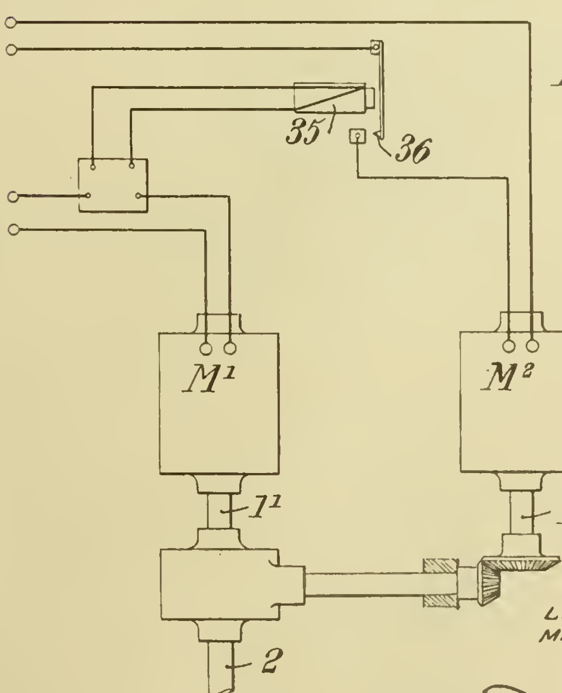

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Fig. 13.

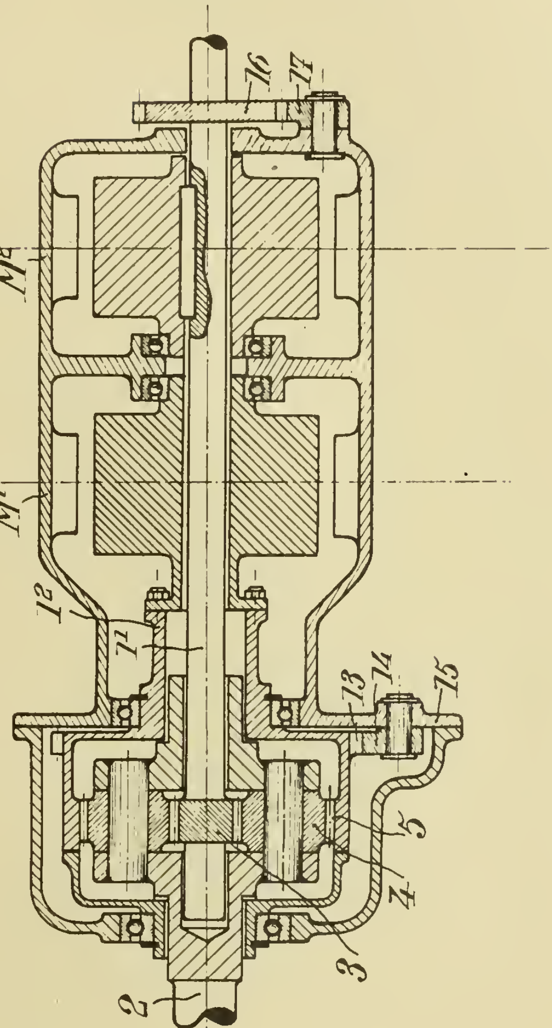

Fig. 14

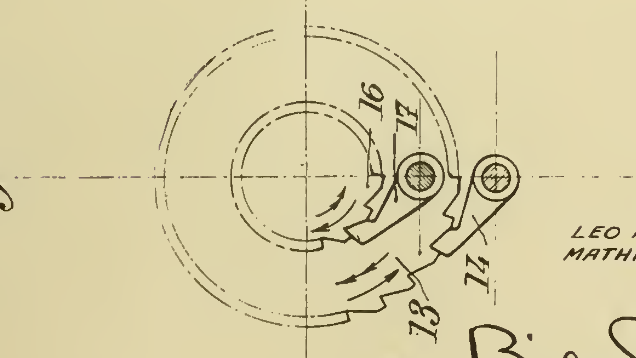

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Fig.15.

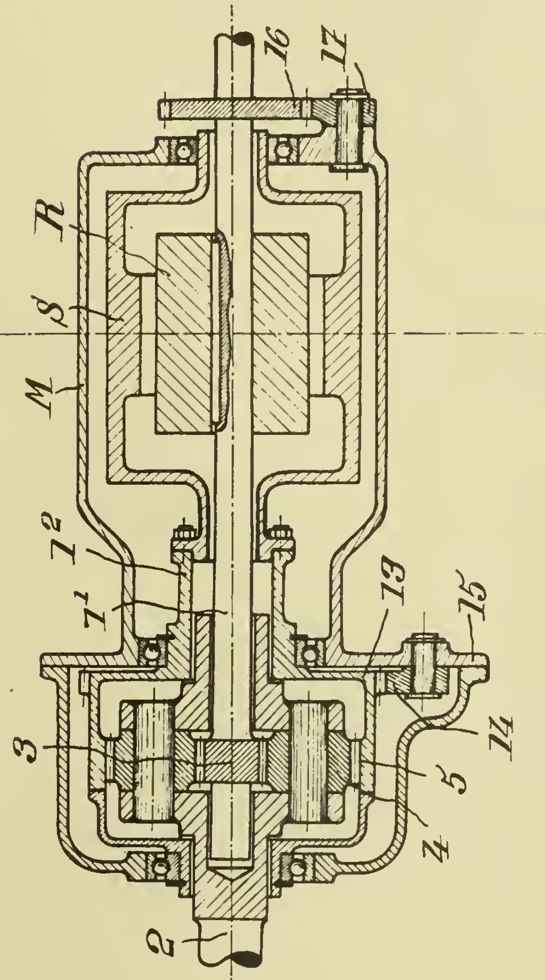
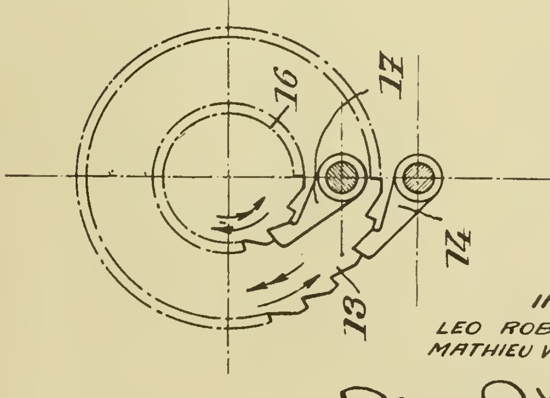


Fig.16.



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ALIEN PROPERTY CUSTODIAN

FIRING DEVICES

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Application filed December 18, 1939

This invention relates to firing devices and more particularly to firing devices to be used in connection with guns or ordnances in order to perforate the closure for the bore of the barrel.

As compared with known devices of this kind, which comprise a sinking member provided with several superposed detachable gun-bodies inserted thereinto and with priming wires mounted in the several powder-chambers, according to our present invention the gun-body consists of an integral block provided with the bore of the barrel as well as with the powder-chamber, said chamber being accessible by means of at least one detachable closing member.

The gun-body which according to our invention is made of one piece and comprises the barrel as well as the powder-chamber is of extremely strong construction and is further strengthened by a close fit of said sinking member so that the latter will form a reinforcing jacket for said gun-body. Owing to the construction of the gun-body as one piece there will be attained the further advantage of having a relatively long bore of the barrel which is favorable with respect to the guiding of the projectile as well as with respect to the general ballistic properties of the gun. This construction further permits the gun-body of being conveniently taken out and again inserted so that it may be charged and prepared for service outside of the gun proper.

Our present construction of the gun-body will further permit to utilize the properties of the structural material to the greatest possible extent and to attain in connection therewith an essential saving in space and an essentially improved firing power of the gun. As a result of this the gun-body may be reduced in diameter to be used with barrels of a caliber as small as it is possible with respect to efficient firing.

Our invention furthermore obviates certain further drawbacks arising in known constructions of guns of the present kind, these drawbacks being due to the difficulties connected with the proper tightening of the priming wire at the place of introduction into the gun-body. According to our invention such tightening is brought about by means of a special member, preferably of the form of a strong sleeve of metal, which is inserted into the powder-chamber and carries the priming wire together with the means for introducing the same into said chamber, said member further serving to close up said chamber against the bore of the gun-barrel. Furthermore, the wall of said member or sleeve is properly dimensioned in the first place to tighten the point of entrance of the priming wire into said chamber by action of the pressure of explosion and in the second place to serve as an element for increasing this pressure. In this way said member may also be constructed in the form of a closed sleeve serving for the reception of the powder charge.

In the accompanying drawings which form part of this specification we have shown an example of construction of our new firing device, Fig. 1 being a partial longitudinal view of the aforesaid sinking member with the gun-bodies inserted thereinto, Fig. 2 a similar view of said sinking member in a position turned through ninety degrees with respect to Fig. 1, Fig. 3 a transverse section along line A—B of Fig. 1, Figs. 4 and 5 an enlarged longitudinal and transverse section, respectively, through said sinking member with the gun-bodies inserted thereinto, Figs. 6, 7 and 8 a further enlarged longitudinal section, planview and perspective view, respectively, of a tightening and closing member of the form of a sleeve destined to be mounted in the powder-chamber.

Referring more particularly to the drawings, the device forming part of our invention consists of a sinking member 1 preferably composed of a plurality of parts, and of a plurality of superposed gun-bodies detachably inserted thereinto with their orifices 3 in different directions, the several powder-chambers of said gun-bodies being provided with electrically operated priming wires mounted in said sinking member.

According to our invention furthermore the gun-bodies 2 that are inserted into the sinking member 1 consist each of an integral block with a bore 3 and the powder-chamber 4 provided therein, said powder-chamber being accessible by at least one detachable closure.

In this example of construction there is assumed—as may particularly be seen from Figs. 4 and 5—that the powder-chamber 4 is formed by a bore directed perpendicularly to the axis of the barrel, said bore being closed up by means of two oppositely positioned fittings 5 and 6. Above these fittings 5 and 6 a preferably hardened sleeve 8 is mounted in said sinking member 1, said sleeve 8 being introduced at its rear part which preferably is of conical conformation. An annular electrical conductor 9 is provided on said gun-body, said conductor making contact with the contact member 10, an electrical circuit being thus established between the priming cable mounted in the sinking body 1 and the chamber

for the powder-charge, when the gun-body is inserted into said sinking member. The gun-body is threaded into the sinking member 1 and fits closely, that is without any intervening interstice, the sleeve 8, or, what is the same, the sinking member, so that the latter will closely surround the gun-body and form a re-inforcing wall therefor. The priming cables are mounted within a groove 11 which preferably is of helical conformation and extends over the periphery of the sinking member. Said groove 11 is covered up by means of a ledge 12 which is welded to the sinking member 1, thus tightly closing said groove. The ledge 12 is provided at proper places with apertures which may be closed by means of screws 12′ permitting access to said groove and the cable therein at the point of contact with the contact member 10.

Access to the powder-chamber 4 may be had by unscrewing the gun-body 2 and removing the fittings 5 and 6, so that on the one hand the projectile may be introduced through said fittings and on the other hand the powder-chamber may be charged with powder. The latter may be inserted into the powder-chamber in loose condition or enclosed within a container or cartridge.

In the gun-body there is further provided a channel 7 leading to the current conductor 9 and containing the priming cable that connects said conductor with the powder-chamber 4.

Owing to the high pressures arising in the device there must be provided special tightening means which, however, can be applied only with difficulties at the place of introduction of the priming cable.

In this respect there is provided a remedy according to our invention by using a fitting inserted into the powder-chamber, said fitting being preferably of the form of a sleeve as shown in a small scale in Fig. 4 and in a larger scale in Figs. 6, 7 and 8. This fitting *h*, *h′* is made of strong material and, for instance, may be drawn from a piece of metal of sufficient strength. The primer *s* is mounted on the cover of the fitting *h*, one carrier for the primer being in conductive connection with the body of the fitting, while the other carrier *d* serves as current supply member for the primer. For this purpose the carrier d_1 is mounted at some point remote from the point d_2 at which the priming wire comes out of the groove 7 in the gun-body. The stretch d_1—d_2 of the priming wire is further so mounted within a groove *n* of the fitting *h*, *h′* that by action of the gas-pressure the wire will be pressed against the surface of the powder-chamber so that the wire introduced into said chamber will be tightly enclosed all around.

The fitting thus tightly closes up with its peripheral surface *h′* the bore 3 of the barrel and is properly dimensioned to serve at the same time as a cover for the barrel. This cover will be subject to rupture, thus permitting the gases to act upon the projectile not sooner than a sufficiently large gas-pressure has been developed in the powder-chamber.

The fitting may be open at one side thereof, as shown, but instead thereof it may also be provided with a bottom *b*, as indicated in Fig. 6. In this case the fitting consists of a closed container or cartridge containing the powder-charge, said container or cartridge effecting itself upon explosion the tightening against the place of introduction of the priming wire and forming at the same time the surface which serves to cause the gases to act on the projectile as soon as the gas-pressure has attained a value sufficient to effect a rupture of the wall at the place of the barrel and to force the projectile through the latter.

WALTER LAMPEL.
RICHARD HÖRNDLEIN.

PUBLISHED MAY 4, 1943. BY A. P. C.

W. LAMPEL ET AL

FIRING DEVICES

Filed Dec. 18, 1939

Serial No. 309,858

3 Sheets-Sheet 1

Fig. 1

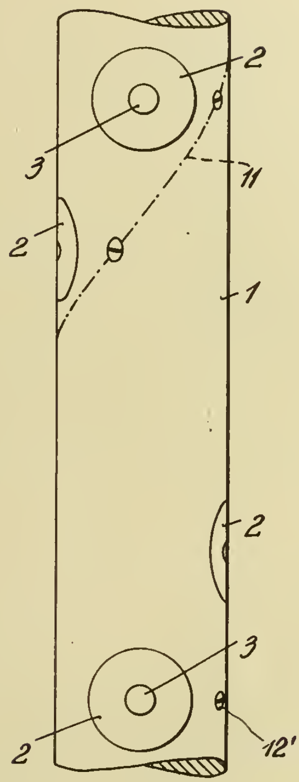
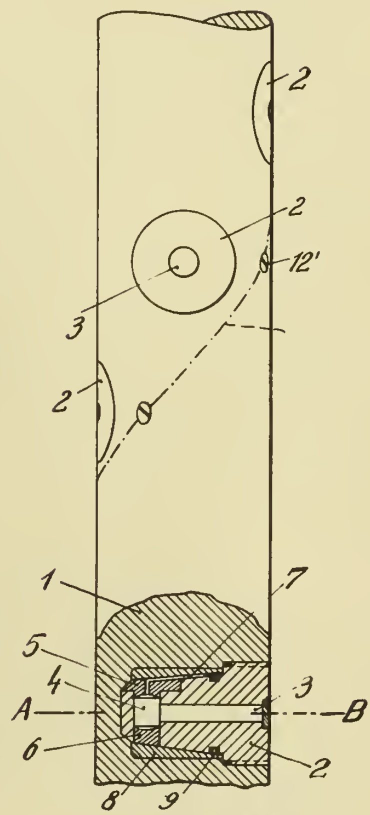


Fig. 2



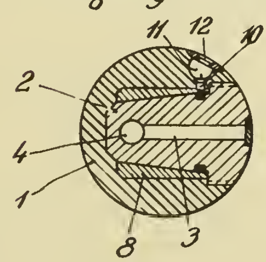


Fig. 3

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FIRING DEVICES

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3 Sheets-Sheet 2

Fig. 4

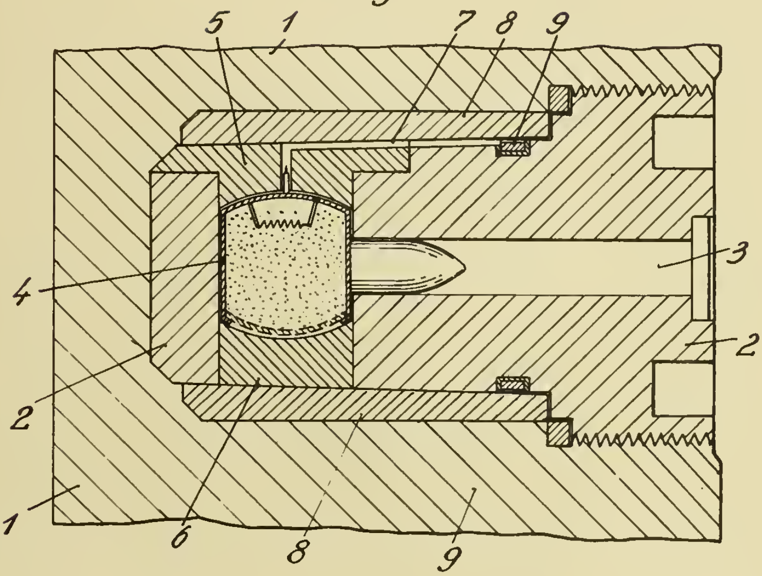
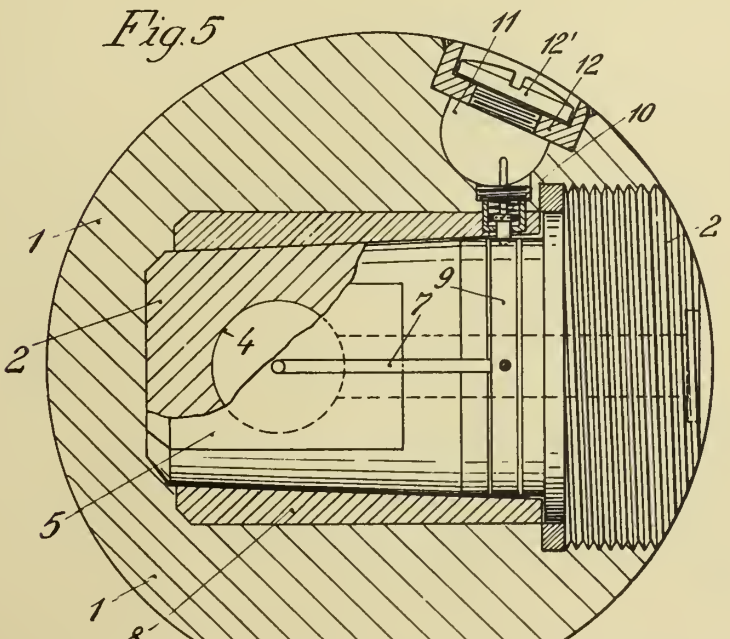


Fig. 5



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3 Sheets-Sheet 3

Fig. 6

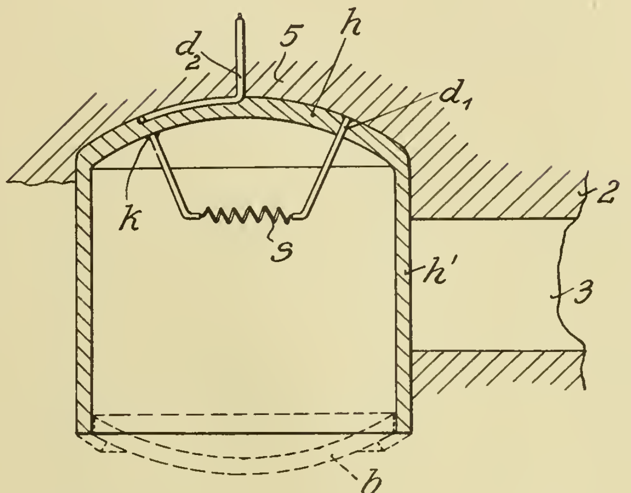


Fig. 7

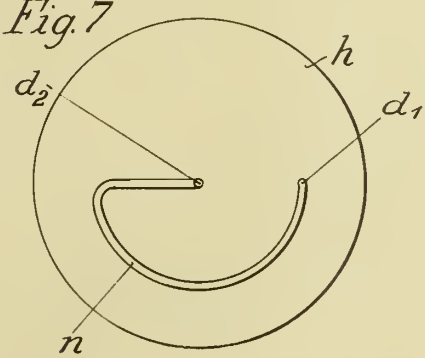
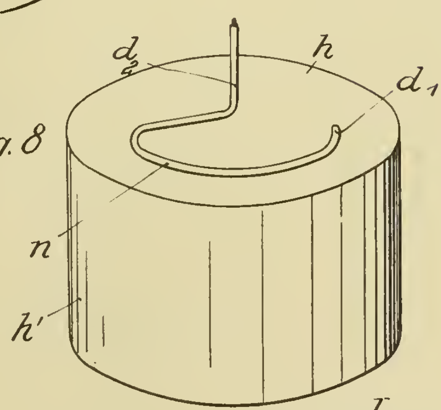


Fig. 8



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ALIEN PROPERTY CUSTODIAN

COMPOSITION MORE PARTICULARLY FOR AGRICULTURAL USE

Alberizzi Ernesto, Milan, Italy; vested in the Alien Property Custodian

No Drawing. Application filed December 23, 1939

This invention has for its chief object to provide an improved composition which is more particularly intended for agricultural use and which can be applied directly or indirectly for the purpose of accelerating and improving the growth of plants of all kinds.

A more specific object of the invention is to provide a composition comprising whey, skimmed milk and a nitrogenous substance which preferably has an oligodynamic effect on the germination and development of plant life.

Further objects and features of the invention will appear from the following description.

It is well known that ordinary unskimmed milk is caused to coagulate by the addition of rennet and the liquid remaining after the coagulum or curd has been removed is called whey. This whey is used industrially for the manufacture of a butter-milk cheese known as "ricotta." The term "whey" as used in the accompanying description and in the appended claim is, however, to be considered to mean the liquid from which "ricotta" has been made.

For the manufacture of butter the cream is removed from milk by any suitable means, such as for example by means of a centrifugal separator; the remaining liquid is known as "skimmed milk" and is that which is referred to throughout this Specification.

These two substances, the whey and the skimmed milk, constitute two of the essential ingredients of the composition according to the invention and are rich in micro-organisms which have an important biological action.

The third essential ingredients is a nitrogenous substance. This serves to feed the bacteria in the composition and is preferably so selected that it will, itself, assist the action of the mixture by having an oligodynamic effect on the germination and development of plant life by influencing the cell growth and the multiplying activity of the cell.

By admixing the aforesaid ingredients, preferably with the addition of water, a composition is obtained which has a number of important agricultural uses.

This liquid may be mixed with or applied, for example by sprinkling, to any organic refuse such as sweepings, algae, rags, leaves, vegetable residues, manure and the like and effect a substantial reduction in the time necessary for these substances to break down to form humus owing to its chemical and biological action.

Moreover, the humus thus formed has improved characteristics as compared with the humus which is formed by natural decomposition. For one thing it causes seeds to germinate more rapidly while a quick growth of the young plants and better formation of the roots is obtained.

Seeds, sprigs, cuttings and the like can also be treated with the composition, when being planted, for the purpose of assisting their germination and growth, while the liquid can be sprinkled directly onto the land with the same object in view. Fertilisers, more particularly phosphorites, can advantageously be acted upon by the composition according to the invention, for it causes the tricalcic phosphates to be partly converted into monocalcic and bicalcic phosphates, the action being not only chemical but also, to an indeterminate extent, biochemical.

Organic refuse substances, such as the contents of cesspools and drainage can be treated with the composition and thereby constitute a product which, when used as a fertiliser, has a greatly improved effect as regards the germination and growth of plant life.

This treatment can be effected in any suitable means and in any suitable apparatus, such as the cells and other devices already known and used for the hygienic maturation of refuses.

A preferred composition according to the invention comprises a mixture of whey, skimmed milk, red haemoglobin and water. Apart from the water the major constituent is whey which can form between 15% and 45% of the whole.

The skimmed milk may constitute between 10% and 30%, while the haemoglobin is present to the extent of between 1% and 10%.

The following composition according to the invention has been found to be very satisfactory:

	Per cent
Whey	38.80
Skimmed milk	19.40
Red haemoglobin	2.90
Water	38.90

This composition can be prepared by dissolving the red haemoglobin in a sufficient quantity of water in a vat or mechanical stirrer. The latter should be operated for a sufficient time to ensure that the semi-liquid solution obtained is of uniform consistency.

At the same time, the whey and skimmed milk are introduced into another vat or stirrer which may be graduated. Preferably the whey is allowed to acquire the normal room temperature before being introduced into the vat. If the whey and skimmed milk mixture should give an

and can produce a forward- or rearward-carrying effect which may combine with or against the motive action given by the slant of the axis of the tube, to accelerate or retard progress of material through the mill, as may be desired for manufacturing purposes.

According to the invention, the different projections aforesaid may be either cast together with the bottom plate, or assembled on this latter.

In the case of Figures 4 and 5, a perforated plate, consisting of fins 8 and 9 or 10 and 11, may be assembled on bottom plate 2.

The several segments herebefore described and represented are only particular constructional examples of the invention. Several constructional modifications may be used without transgressing the limits of the invention.

For instance, projections 3 may assume a cylindrical shape instead of being truncated cones.

Fins 9 and 11 must not necessarily be less in height than 8 and 10, but may be equal or even higher.

At last, fins 9 may assume a quincuncial disposition, whereas fins 11 may be in alignement. Fins or parts 5, 6, 7, 8, 9, 10 and 11 must not need be orthogonal, they may form whichever angles are found best suited for constructional or users purpose. Projections may also be attached—e. g. in form of a perforated plate—directly to mill shell, suppressing the bottom plate.

JACQUES FERNAND HENRICOT.

PUBLISHED

MAY 4, 1943.

BY A. P. C.

J. F. HENRICOT
LINING FOR TUBE MILLS OR CRUSHING MILLS
CONTAINING BALLS OR SIMILAR
CRUSHING BODIES
Filed Jan. 2, 1940

Serial No.
312,133

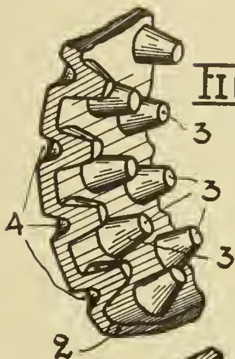

Fig. 1

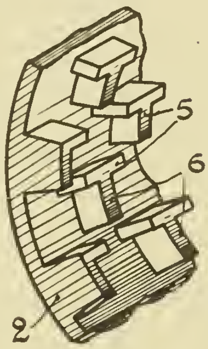

Fig. 2

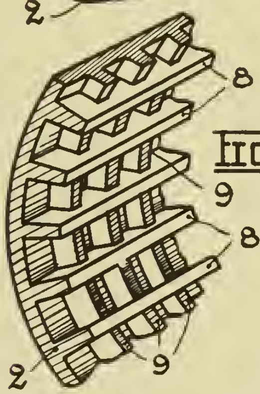

Fig. 4

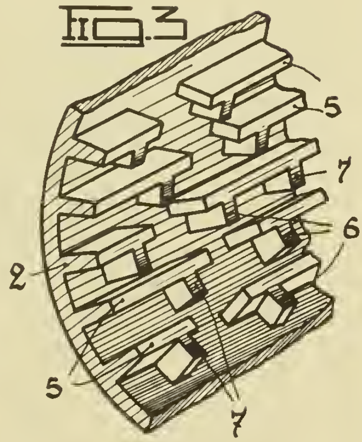

Fig. 3

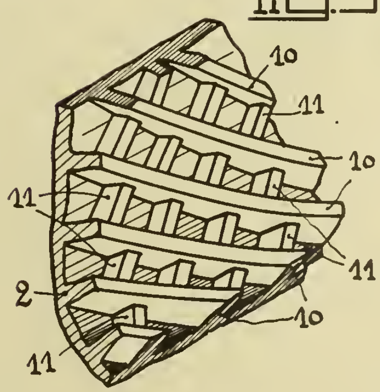

Fig. 5

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ALIEN PROPERTY CUSTODIAN

CIRCULAR KNITTING MACHINES

Robert Buck, Rottenburg A. N., Germany; vested in the Alien Property Custodian

Application filed January 5, 1940

In circular knitting machines it has already been proposed to actuate the needles singly by means of rotary cam track members, in order to achieve a knitting operation continuously progressing in a circular path. The warp threads or the thread crossings formed thereby are brought into the path of the needles by the uppermost throat of multi-throated sinker bars, said bars having hooks which on downward movement of the bars grip the thread crossings in order to subject them to the shed or loop forming operation. The sinker bars themselves which are associated with the machine needles are mounted in a fixed guide ring in such a manner that the radial actuation of the said bars also requires cam means moving in a curved path. Under these conditions a common drive for the circular movements of the needles and sinker bars has been provided. The cam contour, however, could be such that each needle or sinker bar during one rotation of the cam means will move up and down four, eight or twelve times, whereby the output of the machine is correspondingly increased. Owing to the presence of the cam means required for the actuation of the sinker bars, the accessibility of the machine and its control by an operator are considerably impaired because the arrangement of the necessary mechanism around the working circumference of the machine occupies useful space apart from the fact that the mechanism itself is expensive to manufacture.

The present invention provides a circular knitting machine in which instead of the sinker bar guide ring, a sinker wheel is employed, having sinker throats which seize the thread crossings and move them to the downwardly moving needles. The shaft of the sinker wheel moves in a planetary path around the needle cylinder at the speed of the cam track member which actuates the needles, so that the above mentioned coordination with the cam track for actuating the needles, is guaranteed.

Such constructions embodying the invention are diagrammatically illustrated in the drawings in which,

Figure 1 is a partial sectional view of the rings,

Figure 2 is a partial side view of the wheel,

Figure 3 is a view similar to Figure 1 of a modified form,

Figure 4 is a diagrammatic view and a sectional view illustrating the method.

Figure 5 is a view similar to Figure 4,

Figures 6 and 7 are side views of two forms of needles,

Figure 8 is a diagrammatic view illustrating the cam track,

Figures 9 and 10 are sectional views illustrating the method,

Figure 11 is a plan view of certain details,

Figure 12 is a sectional view of Figure 11, and

Figure 13 is a cross sectional view of the machine.

The upper and lower warp threads f_o and f_u pass from the warp bobbins to the heald rings e_o and l_u from which they pass as shown in Fig. 1 of the machine needles. A cam track member k rotates in a planetary path around the needle cylinder z which carries the needles n which cam track member carries a bearing l for a shaft a. The sinker bars p are mounted in radial or tangential slots in a sinker wheel comprising discs d_e, d_o between which they are pressed. The drive of the sinker wheel is effected by a guide wheel u which meshes with a fixed toothed ring o. The guide wheel engages either the shanks of the needles n or ribs s_t on the cylinder, and the bearing l of the shaft a is also mounted on the rotary cam track member k. In this connection it should be understood that the drive may also be effected independently of the cylinder and the rotary cam track member k.

The sinker wheel may be so formed that lugs s on the sinker bars k are guided by a cam track which does not rotate with the wheel but is fixed on the bearing l whereby, the sinker bars in addition to their circular movement may receive simultaneously a radial movement beyond the duration of the insertion of the needle produced by the cam track This latter arrangement is not shown in the drawings.

In the modification shown in Fig. 2, the sinker wheel is replaced by a toothed wheel r_z driven in the same manner as the sinker wheel. In this arrangement, however, there are no sinker bars as shown in Fig. 1, between the thread crossings, but teeth are provided on the circumference, the spacing of which corresponds to that of the thread crossings.

According to another modification, even the teeth of the wheel are eliminated, and the wheel r_g as shown in Fig. 3 has its circumference quite smooth. This smooth wheel r_g is driven in the same manner as the sinker wheel and the toothed wheel r_z.

The use of these different wheels clearly indicates that even in a plural system machine there is always enough space available between the separate systems to give accessibility and easy supervision of the machine.

Furthermore, in spite of the increased rapidity of operation, there is greater reliability apart from the fact that the novel constructions are essentially simpler to manufacture and therefore cheaper than the previously known arrangements.

A further modification is shown in Fig. 4, in which instead of a driven wheel, a thread guide cam *b* is employed which may be fixed on the needle cam track member *k*. This circularly moving member at a certain instant forces or displaces the crossing of the threads *f* sufficiently far in the radial direction that they come into the path of the downwardly moving needle hooks whereby the in-drawing of the warp threads can take place in known manner. This modification has the further advantage over the previous constructions that no drive elements are present or necessary. This results in greater reliability of operation as well as improved accessibility, ease of operation, and simplicity of manufacture.

From the foregoing constructions it will be seen that the sinker bars of the sinker wheel, the toothed wheel r_z and smooth wheel r_g, also the thread guide cam *b*, each serve the purpose of forcing the thread crossing in radial direction into the path of the needle hooks, whereupon the needles on their downward movement draw in the new threads required to form the loop or shed. This displacement of the warp threads must naturally be kept as small as possible so that the tendency is to keep the angle of inclination a_o and a_u between the upper and lower warp threads, and the vertical needles, Fig. 5, as small as possible.

To assist in achieving this purpose the present invention provides a hook needle, as shown in Fig. 7, having a head of novel form, as will be seen by comparison with the usual needle shown in Fig. 6. The hook of the new needle is formed as a guide cam so that the ejecting upwardly moving needle contacts the thread crossing at the point P (Fig. 5) which point corresponds to the point F shown in Fig. 7, so that the head slides along the thread crossing, due to its curved form, and the thread crossing is thereby displaced slightly in the radial direction, and after leaving the needle head, it returns to its natural position owing to the tension in the thread. In the ensuing downward movement of the needles, the upper warp thread f_o is thus located near the needle hooks, while the lower warp thread f_n, owing to its somewhat greater angle of inclination a_u, still lies somewhat outside of the needle hook.

There will now be described a further and very important feature relating to this minimum radial displacement of the warp threads at the needles. Fig. 8 shows a formation of the cam track member *k*, which moves from right to left. The needles *m*, separately movable in the fixed cylinder *z*, are brought from the base position G into the ejecting position A in order to bring the fabric W (Fig. 9) reliably behind the needle hooks, without requiring the use of any auxiliary means such as sinkers, clamp rings or the like to hold back the fabric. The needles *n* are not withdrawn as heretofore in a single stroke, but in two strokes by means of of a double stepped cam. The first in-drawing step E_1 terminates at the instant that the fabric *w* on the needles begins to touch the hooks and thus is not yet closed. Owing to the ensuing downward movement of the needles, the needle hooks draw the thread crossings of the warp threads f_o and f_u closer, so that the thread guide cam *b*, shown for example in Fig. 10 has to effect a shorter displacing movement to force the warp threads into the needle hooks, which movement may be produced by the shape and position of the thread guide cam. The second in-draw in step E_2 now takes place, beginning at the instant that the warp threads or their crossings are moved to the needle hooks, whereby uniform loops or sheds are formed, this instant being designated by the extended portion A_2.

In this connection a new feature in loop sinking should be noted because whereas in all other machines with separately movable needles one needle must complete the loop forming operation before the next begins such operation, in the present invention two or even more needles can form loops almost simultaneously.

In view of this feature it will be clearly recognized that the above mentioned shifting of the thread crossing is very slight so that it is practically impossible for any of the threads to get out of place whether by action of the sinker wheel, of the toothed wheel, of the smooth wheel, or of the thread guide cam.

The above mentioned almost simultaneous loop sinking of a plurality of loops has a great advantage from the mechanical point of view that the cams for the ejecting and in-drawing movements of the needles do not have such abruptly varying contour as in known circular knitting machines, whereby a higher speed of operation and a correspondingly greater output can be achieved without the danger of breaking off needle heads, bending cylinder ribs, or injuring needle channels due to excessively abrupt variation in the contour of cams.

In circular knitting machines for the manufacture of chain knitted goods, in which the knitting operation advances continuously in a circular path, means have already been provided for individually tensioning the threads whereby each warp thread is imparted the necessary tension for the knitting operation. Mechanism of this kind is very cumbersome, complicated, difficult to overlook and consequently expensive because each separate thread tensioning device must have an adjustable equalization of tension by such means.

The present invention provides thread tensioning means arranged in groups and controlled by springs or weights, the regulation of which can be carried out in very much simpler and easier manner than heretofore, whereby greater facility of supervision of the machine results. The novel arrangement also provides more reliable operation because there is also means for equalizing the tension inside the groups themselves since the device controlling the threads of each group can yield not only in the drawing-in direction, but also in the transverse direction. Since each individual group is yieldably mounted transverse to the drawing-in direction, the whole aggregate can be subjected to a displacement so that a complete accommodation of the warp threads to the advancing knitting operation is possible. This novel mechanism is shown in Figs. 11 to 13. The warp threads f_o and f_u pass through eye plates r_o and r_u and combs m_o and m_u to the heald rings l_o and l_u from the upper and lower warp bobbins s_o and s_u, and are guided to the needles *n*. The number of threads from one and the same warp bobbin may be divided into six, eight, or more groups. Each group, for

example of the lower threads, has assigned thereto an eye plate r_u, these being designated in Fig. 11 ru_1, ru_2 and ru_3. These eye plates r_u are shown in Fig. 12, for example, as under the influence of a helical spring s_p to hold the threads f_u in properly tensioned condition. The shifting of the eye plates r_u transversely to the drawing-in direction, which provides a further adaptation to the progressive knitting operation, is obtained as shown in Fig. 11 by a loose mounting of a lever l_u of the plate r_u in a cross bar B, which also carries the comb n_u. The above mentioned yielding of the aggregate in order to permit more perfect adaptation of the thread tension to the continuously progressing knitting operation, is obtained by suitable mounting of the cross bar B in left and right hand levers H_u, which levers rotate about a fixed shaft x supported by a frame member t_u.

ROBERT BUCK.

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MAY 4, 1943.
BY A. P. C.

R. BUCK

CIRCULAR KNITTING MACHINES

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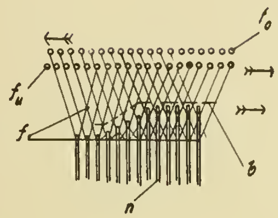
Serial No.
312,595
4 Sheets-Sheet 1



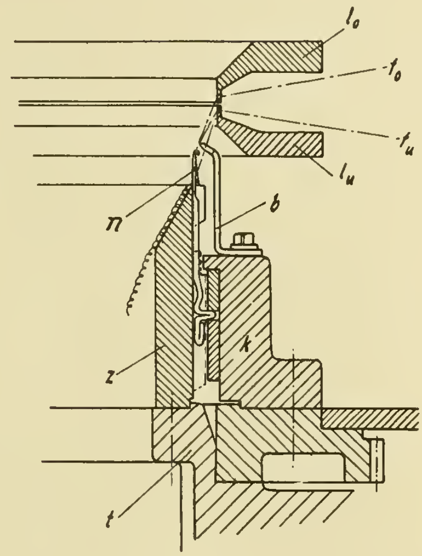


Fig. 4

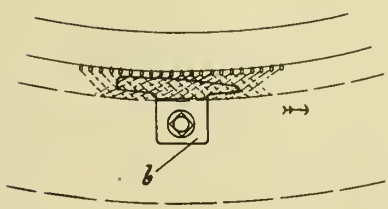


Fig. 3

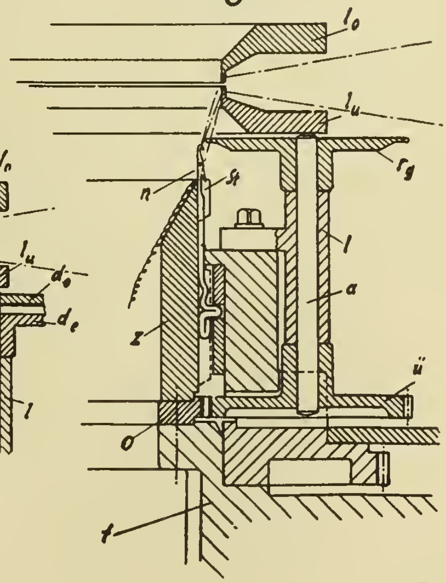


Fig. 1

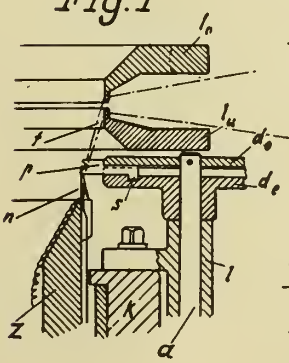


Fig. 2

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CIRCULAR KNITTING MACHINES

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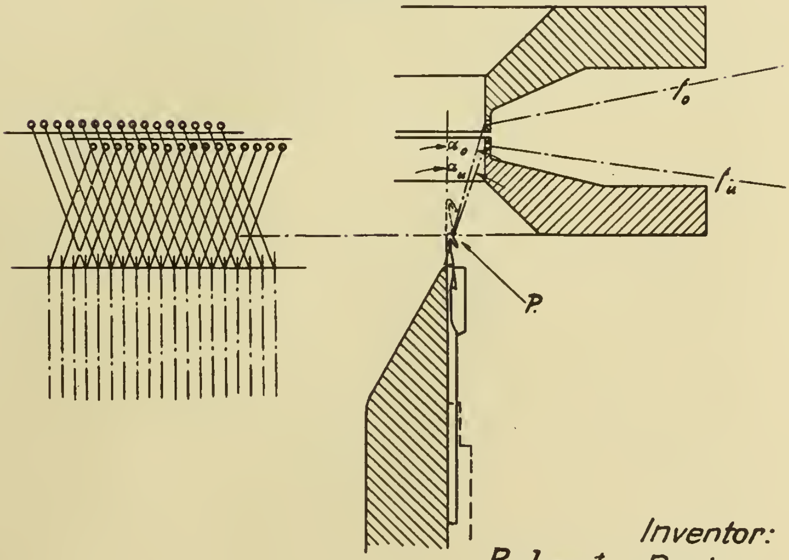
4 Sheets-Sheet 2

Fig. 6

Fig. 7

Fig. 5



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CIRCULAR KNITTING MACHINES

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Fig. 8

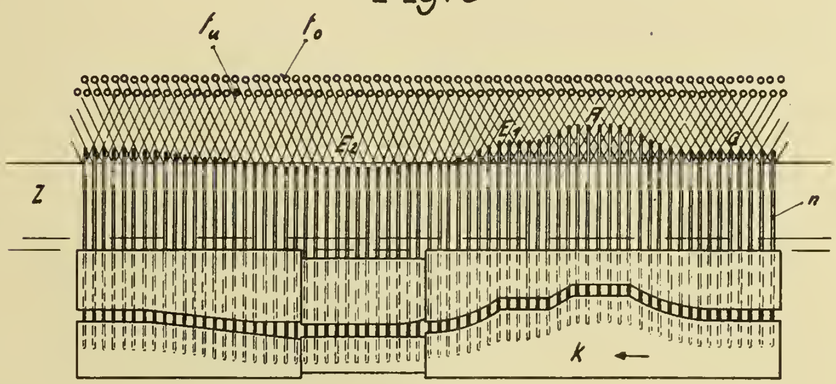

Fig. 10

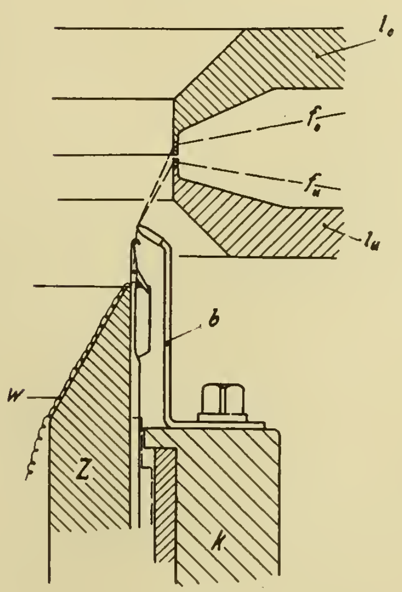

Fig. 9

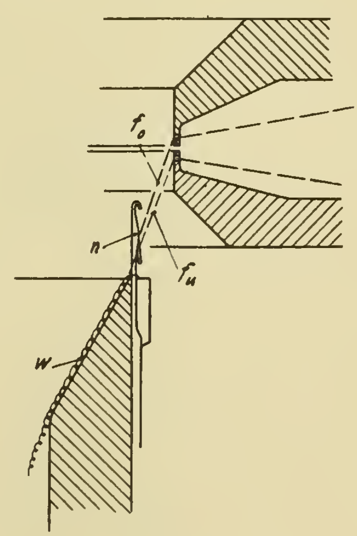

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Fig.13

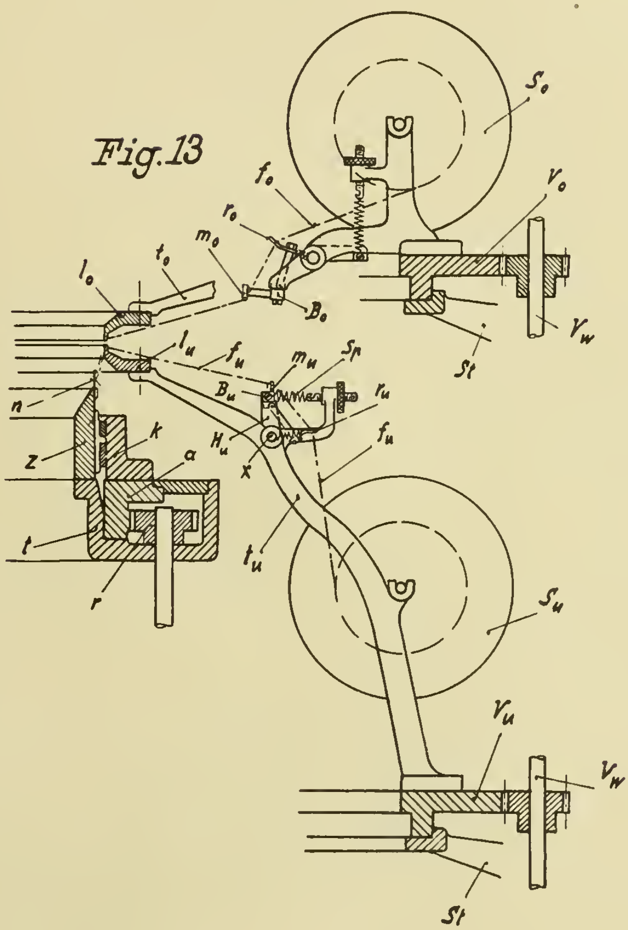


Fig.11

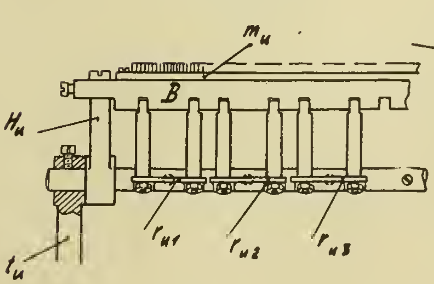
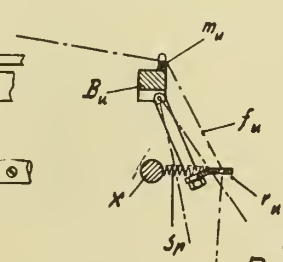


Fig.12



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ALIEN PROPERTY CUSTODIAN

ANGULAR RATE GYROSCOPE FOR AUTOMATIC STEERING

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It has been proposed to use for automatic steering devices for aircraft, in addition to an attitude impulse necessary for stabilization, impulses relating to angular velocity and angular acceleration in order to obtain the high degree of damping which is necessary, if the aircraft is to be kept with great accuracy to its coordinate system. It is possible to use a restrained gyro which will measure angular acceleration by means of its precession due to changes of angular velocity. This can be accomplished by measuring the torque exerted by the rotor bearing frame against its bearings during precession. There is the further possibility of finding the angular velocity from the amplitude of the precession angle of the gyro rotor bearing frame of the same gyroscope.

The object of the invention is a relatively simple gyroscopic device which permits mutual adjustment of the impulse values due to angular velocity and angular acceleration, and which is particularly adapted for use as impulse generator for an automatic steering device for aircraft. The gyro is suspended in gimbals and the gyro rotor bearing frame as well as the outer gimbal ring are spring restrained against the housing. The restrainment is comparatively weak for the rotor bearing frame, but very strong for the gimbal ring, the gimbal ring being connected to a power control device for transmitting the two measured values. In adjusting the relative proportions of the two sets of restraining springs in order to adapt the device to the particular conditions under which it is to be used, it is necessary to keep in mind that the rotor bearing frame must have sufficient freedom for precession in order to be able to transmit to the gimbal ring a sufficient reaction as acceleration impulse, while the motions of the gimbal frame should be kept as small as possible.

In order to prevent oscillation of the gyro system, we prefer to provide a damping device which keeps the rotor bearing frame in a definite relation to the housing. As it is characteristic of a damping device to form the derivative of the measured value, it is possible to increase the impulse due to angular acceleration if the damping device is so arranged that it acts in the same sense against the gimbal frame as the torque resulting from the bearing pressure of the rotor bearing frame. This is the case if the damping device is arranged in one of the two angular sections which extend from the precession axis of the rotor bearing frame in the direction of rotation of the gyro to the main gimbal axis, as may be proved easily from the theory of the gyroscope.

In order to obtain an impulse due to angular velocity, the restraining spring for the rotor bearing frame must be so arranged that as the spring is loaded, a torque around the main gimbal axis is exerted on the gimbal frame. In order to add the angular velocity impulse to the angular acceleration impulse in the correct sense, the point of attachment of the restraining spring must be located in the same or at least in the diametrically opposite angular section as is the damping device.

As it is necessary, with a view to the correct functioning of the device, that the movements made by the gimbal frame should be very small, it is imperative to provide suspension of the gyro free from back-lash and without any lost motion, and furthermore, friction must be limited to the minimum. These requirements are fulfilled in the further development of the invention by using leaf springs or spring wires as suspension means for the gimbal frame and for the linkage attached to the gyro.

It was found that due to the yielding of the gyro around the main gimbal axis, there is sensitivity to angular velocities around an axis in the plane of measurement vertical to the gyro rotor axis. It is possible to compensate for this often disturbing influence by inclining the axis of the gyro rotor bearing frame against the plane of measurement. As shown by a vector diagram and confirmed by experience, the influence of the disturbing angular velocity is eliminated if the point at which the spring attaches to the rotor bearing frame is located in the plane of measurement going through the point of intersection of the gimbal axes, which, in the case of an automatic course steering device, is in the horizontal plane going through the intersection of the gimbal axes. The same is true also for the point of attachment of the damping device which, for practical reasons, preferably is arranged diametrically opposite to the point at which the restraining spring is attached.

It is recommended that the mechanical design of the device be arranged in such a way that the gyro and the power transmission device which transmits the measured values are mounted on a common frame or base plate, and that with vertical arrangement of the gimbal frame the same be suspended by means of leaf springs from a separate carrier frame mounted on the base plate. In order to make vertical dimensions small, it is possible to let the lower part of the last mentioned frame project into the base plate.

Especially characteristic of the embodiment of

the invention as shown in the drawings, illustrating a pneumatically driven device, is the arrangement of air passages inside of the mounting plate through which air is conducted directly to the parts using the air without any pipe lines. In this way a compact arrangement is possible which is easily manufactured and assembled.

Further details of the invention will be apparent from the following description of the embodiment thereof.

Fig. 1 is a side elevation of the device after a protective cover shown in dash lines has been removed. The gyro is mounted in an inclined position on the mounting plate, shown partly in section, and the mounting plate itself is mounted in an inclined position on a separate frame.

Fig. 2 is a view from above without the frame.

Fig. 3 is a view from below.

Fig. 4 is a perspective view of the instrument.

Fig. 5 is a section along line 5—5 in Fig. 1, and shows the arrangement of the leaf springs for the gimbal frame.

The gyro rotor **11** is air driven and is gimbaled on a horizontal spin axis in a frame **12**, which in turn is carried by the gimbal frame **13** in pivots **14**. The gimbal frame is arranged inside of the rotor bearing frame **12** and has a rubber covered stop pin **13'** which serves the purpose of limiting angular precession of the frame **12**. The gimbal frame is mounted in another frame **15** by means of leaf spring **16**.

As shown in Fig. 5, the leaf spring **16** of the upper suspension is mounted against a machined surface of the frame **15** by means of a bolt **17** and a washer **17'**. The other end of the spring is connected by means of bolt **18** and washer **18'** to a projection **13'** of the gimbal frame **13**. The lower suspension of the gimbal frame is designed as an exact equivalent. In Fig. 4, at **17**, one of the two mounting screws for the leaf spring may be seen.

The frame **15** has two projections **19** by means of which it is mounted on the machined surface **20** of the base plate **21**. As seen from Fig. 1, the suspension frame **15** projects at **22** through the frame-like base plate **21**, which has ribs **23**. This arrangement allows secure fastening of the suspension frame **15** and a lower height of the gyro unit. Openings **24** provided in the suspension frame **15** on both sides afford easy accessibility to the bearings **25'** of the gyro rotor axis, which are threaded into the frame **12**.

The gyro drive jet **25** is attached directly to a machined surface **26**. The compressed air is fed to the jet through a passage **27** in the base plate.

The gyro is spring restrained around both gimbal axes. The comparatively weak restraint of the bearing frame **12** is obtained by means of a leaf spring **28** which is attached to a bracket fastened to the base plate at **29**. By shifting of a clamp **32** attached to the bracket **30** by means of a screw **31** (Fig. 2), the effective length of the leaf spring may be adjusted so that the restraint of the rotor bearing frame **12** may be changed. The leaf spring **28** is attached to a projection **35** of the frame **12** by means of two spring wires **33** and **33'** and a stiff intermediate member **34**. The distance of the point of attachment from the axis of the pivot **14** is comparatively small so that the spring has a short lever arm and is not greatly deflected.

In a similar way, on the other side of the frame **12** there is provided a projection **36** (Fig. 1) which is arranged below the pivot bearing **14'** and which, with respect to the rotor spin axis, is located diametrically opposite to the projection **35**. Connected to the projection **36** by means of a similar spring device **37** is a differential pressure diaphragm system which serves the purpose of damping oscillations of the gyro around the secondary gimbal axis **14—14**. In the diaphragm housing **38** (Fig. 2), in the middle of which a metal diaphragm (not shown) is mounted, there is on each side a hole **39** (Fig. 4) the cross section of which is adjustable by means of needle valves **40**. In this way the entrance and exit of air in the two chambers of the housing may be adjusted in order to obtain the desired amount of damping. The use of a metal diaphragm for the damping of oscillations of the gyro rotor frame has the advantage of being free from friction as compared with the piston damping devices employed.

The diaphragm housing **38** is carried by a small bracket **41**, which also carries the relay controlled by the precession amplitudes of the gyro. A pneumatic jet pipe **42** has been provided, which in known manner is arranged opposite to two ports **43** and **44** which are contained in the distributor **45**. In the mean position of the jet pipe, there is equal pressure in the two channels **43'** and **44'** which are connected to the two nipples **46** and **47**. As the jet pipe is displaced from its mean position, a differential pressure is created in the lines which operates a rudder motor, if necessary, through a second relay. The nipples, as shown in Fig. 4, are threaded and are shown with protective caps in all other figures.

The jet pipe **42** is suspended from a projection **41'** by a bracket **41** by means of a leaf spring **48**, free from friction. The member **49** attached to the jet pipe is connected to the lever **50** by means of a multiplication leverage not shown in detail but consisting of a suitable arrangement of leaf springs. The lever **50** is actuated by means of a spring wire **51** from the gimbal frame **13**.

Because of the large multiplication between the gimbal frame and the jet pipe, the suspension spring **48** of the jet pipe together with the other leaf springs in the linkage provide considerable restraint for the gimbal frame **13**, which very often is considerably stronger than the restraint produced by the suspension spring **16**. It therefore may be assumed in first approximation that the gimbal frame, as compared with the restraint of the frame **12** by means of spring **28**, is rigidly connected with the base plate **21** and extremely small turns are sufficient to move the jet pipe **42** in front of one or the other of the ports **43** and **44**.

As may be seen in Figs. 2 and 4, the gimbal frame has on its lower righthand side a reinforced member **52** which carries a fork **53**. The end **54** of the fork (Figs. 2–4) forms a mounting point for the wire **51**, establishing the connection with the damping device **38** while the other end of the fork **55** is connected to a crank **56**, **56'**, which is carried by two leaf springs **57** and which may be oscillated around an axis **58**. The leaf springs **57** are connected at one end to the crank **56** and at the other end to the columns **60** of a member **59** which is mounted on the base plate **21**.

The other end **56'** of the crank is connected by means of a shaft **61** (Fig. 4) with a fork **62**. This fork is moved by a differential pressure diaphragm located in a diaphragm housing **63** mounted from below in the frame-like mounting plate **21**. The vertical movements of the diaphragm are translated into lateral movements by means

of the crank 56. The diaphragm housing 63 has two nipples 65 and 65' (Fig. 3) which fit into corresponding openings of the mounting plate 21. The two chambers of the housing 63 thereby are directly connected to passages 64 and 65 cast into the mounting plate, which in turn are connected to external nipples 66 and 67.

The diaphragm enclosed in the housing 63 is controlled by means of an azimuth gyro, which in known manner produces a differential pressure as the aircraft deviates from its course. Course deviations therefore result in a pressure against the diaphragm which, by means of the linkage, 62, 61, 56', 56, is transmitted to the free end 55 of the crank, which in turn is rigidly connected to the gimbal frame 13.

Before the operation of the device is described, the following additional remarks must be made:

The jet pipe bracket 41 and the distributor 45 are directly mounted on the base plate and thereby connected to passages provided therein in a manner similar to that described for the gyro drive jet 25 and the diaphragm housing 63. The passages 68, shown in Fig. 2 by dash lines and leading to the jet pipe 42, are connected by means of a hole 68' with the same passage 27 in Fig. 3 which also serves the drive jet 25. The supply of compressed air for the passage 27 is obtained from a connecting nipple 71. In order to be able to adjust separately the pressure for the drive jet and for the jet pipe, two needle valves 69 and 70 have been provided, one in the passage 68 and the other one adjacent to the drive jet 25. The operator therefore is in a position to change the gyroscopic effect of the gyro by changing its speed and also to change the maximum differential pressure in the passages 43' and 44'. The steering effect of an automatic steering device for aircraft becomes more rigid as the gyroscopic effect is increased and the steering characteristic of the servo motor becomes stiffer as the pressure in the passages 43' and 44' is increased.

The distributor 45, which carries the ports 43 and 44, is fitted to the machined surface 72 (Figs. 1 and 4) and has on its under side two openings 73 and 74 (Figs. 2 and 3) which are connected to the passages 43' and 44' in the base plate. In order to line up the jet pipe 42 accurately with the ports 43 and 44, the jet pipe itself may be shifted by changing the length of the connecting member 51. Because of the extremely high multiplication between the gimbal frame and the jet pipe, the adjustment is, however, obtained more easily by shifting the distributor 45. For this purpose it is possible to shift the same by means of screw 76 against the pressure of a leaf spring 75, after loosening the two holding screws 77 which, during the adjustment, guide the distributor perpendicularly to the jet pipe, for which purpose slots extending in the direction of movement (not shown) are provided in the distributor instead of holes.

A cover 78, shown in dash lines in Fig. 1, covers the gyro for protection. Also the base plate is covered from below by means of a thin cover (not shown). Nuts 85—87 are used for simultaneous fastening of the top and bottom covers. In such a completely enclosed condition, the device is mounted on the frame 79 which previously has been attached to the floor of the airplane. Universal mounting is obtained by a three-point suspension. The mounting employs rubber links 83 and 84 which yield in case of hard shocks, but which have comparatively little spring action because the gyro must follow all motions of the airplane in order to obtain good steering action.

The operation of the gyro as an automatic steering device for course steering for aircraft is as follows:

As the airplane turns around its vertical axis, the rotor frame 12 of the gyro precesses in a manner similar to that of an ordinary turn indicator gyro around the second gimbal axis 14—14, while flexing the restraining spring 28. This results in a torque around the main gimbal axis as the spring exerts pull or push on the vertical gimbal ring 13 by means of the frame 12. Simultaneously a torque is exerted on the gimbal frame resulting from the precession motion of the frame 12 in the same sense, whereby the jet pipe 42 is displaced in a corresponding sense.

Because of the course deviation, a differential pressure has also been created in the passages 43' and 44' due to the action of the azimuth gyro, which by means of the diaphragm enclosed in the housing 63 exerts a force against the projection 55 of the gimbal frame 13. Furthermore, the reaction of the damping device 38 acts upon the rotor bearing frame 12 and thereby upon the main gimbal frame. All these steering impulses are so arranged in their direction that they add up. If the airplane moves in the direction of the arrow 88, then the gyro, which rotates in the direction of the arrow 89, precesses in the known way as the airplane turns to the left, or clockwise as seen in the direction of flight. The torque resulting from the restraining spring 28 therefore also acts clockwise as the gyro is viewed from above. As the connecting link 37 in Fig. 2 moves upward with the precession motion of the gyro just described, it is obvious that this torque also acts in the same sense against the gimbal frame 13. But the motion of the gimbal frame due to the precession motion of the rotor bearing frame follows in the same sense, which may be seen very easily if the whole gyro system is imagined as a mass with an inertia artificially increased many times. It is then evident that the gimbal frame must move relatively to the right as the airplane turns to the left, thereby trying to maintain its position in space. The impulse obtained from the course diaphragm 63 is so added to the above described action that a pull is exerted on the forked end 55. This means that there must be excess pressure in the lower diaphragm chamber which is connected to the nipple 67.

The clockwise motion of the gimbal frame 13 causes jet pipe 42, by means of the mechanical multiplication, to move a much greater amount to the left. This causes excess pressure in passage 43' which by means of nipple 46 is connected to an intermediate relay or directly to the rudder motor, which now turns the rudder of the airplane towards the right in order to thereby eliminate the deviation from course.

As already described, the inclination of the gyro against the horizontal is used in order to eliminate the influence of angular velocities around the longitudinal axis of the airplane. For this purpose the connecting point 35 of the restraining spring and 36 of the damping device are so placed that the connecting line is located in the horizontal plane and goes through the gyro rotor axis. All rolling motions then are without disturbing influence, which may be explained most simply by the fact that the effective lever arm of the restraining spring or the damping respectively, has been made zero be-

cause the points **35** and **36** have zero distance from a horizontal plane through the gyro axis.

As may be shown by vector analysis, the angular velocity of the roll, in case of still further inclination of the frame, would act in a supporting sense, that is, in case of a rolling motion in counter-clockwise direction resulting from the attempt of a normal airplane to go into a counter-clockwise curve, the effect of the roll would produce a jet pipe displacement to the left in the same sense as produced by a reaction of the gyro to the turning around the vertical axis of the airplane.

This gyro device may be used for the stabilization of an airplane around the longitudinal axis or the transverse axis in the same manner as described for the vertical axis. In most cases the natural damping of the airplane around the two axes just mentioned is so great that the automatic steering device only needs to be equipped with a normal turn indicator gyro, while for course steering, because of the very small natural damping around the vertical axis, it is absolutely necessary to use angular acceleration values caused by the motion of the gimbal frame.

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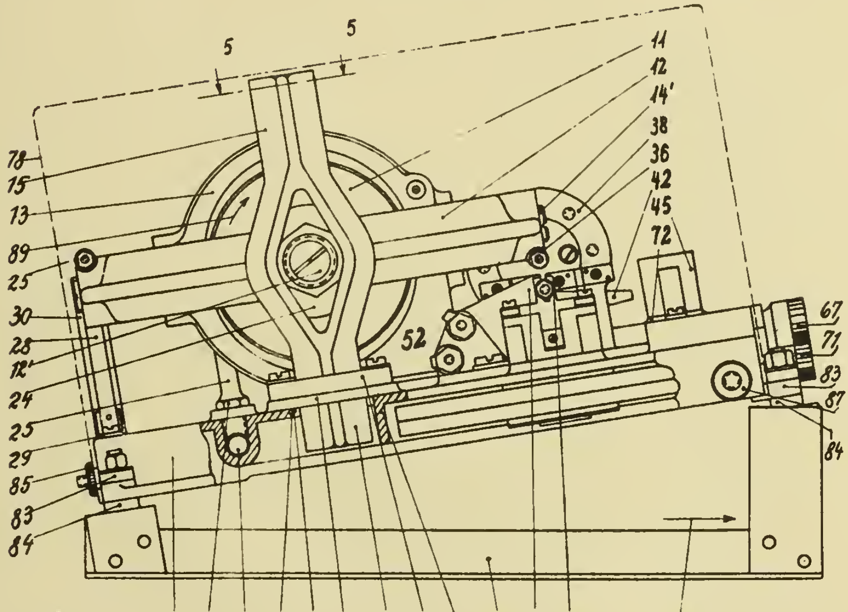

Fig. 1

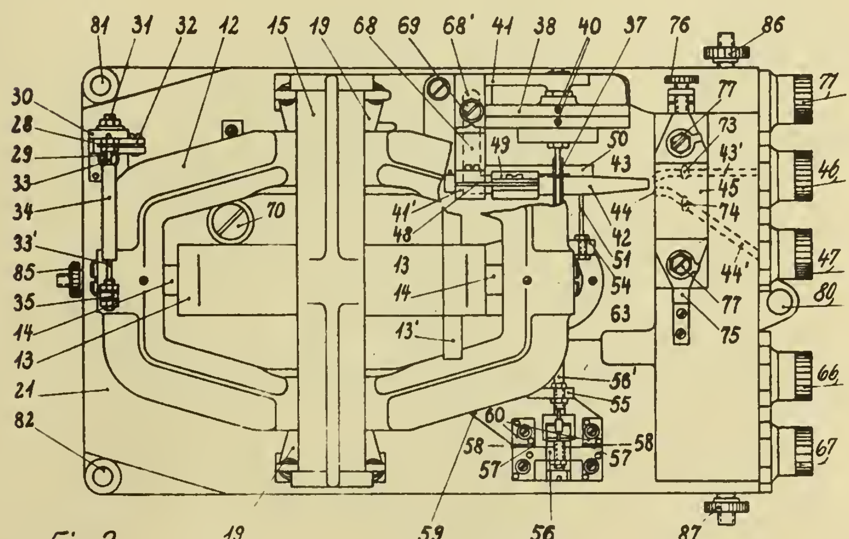

Fig. 2

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